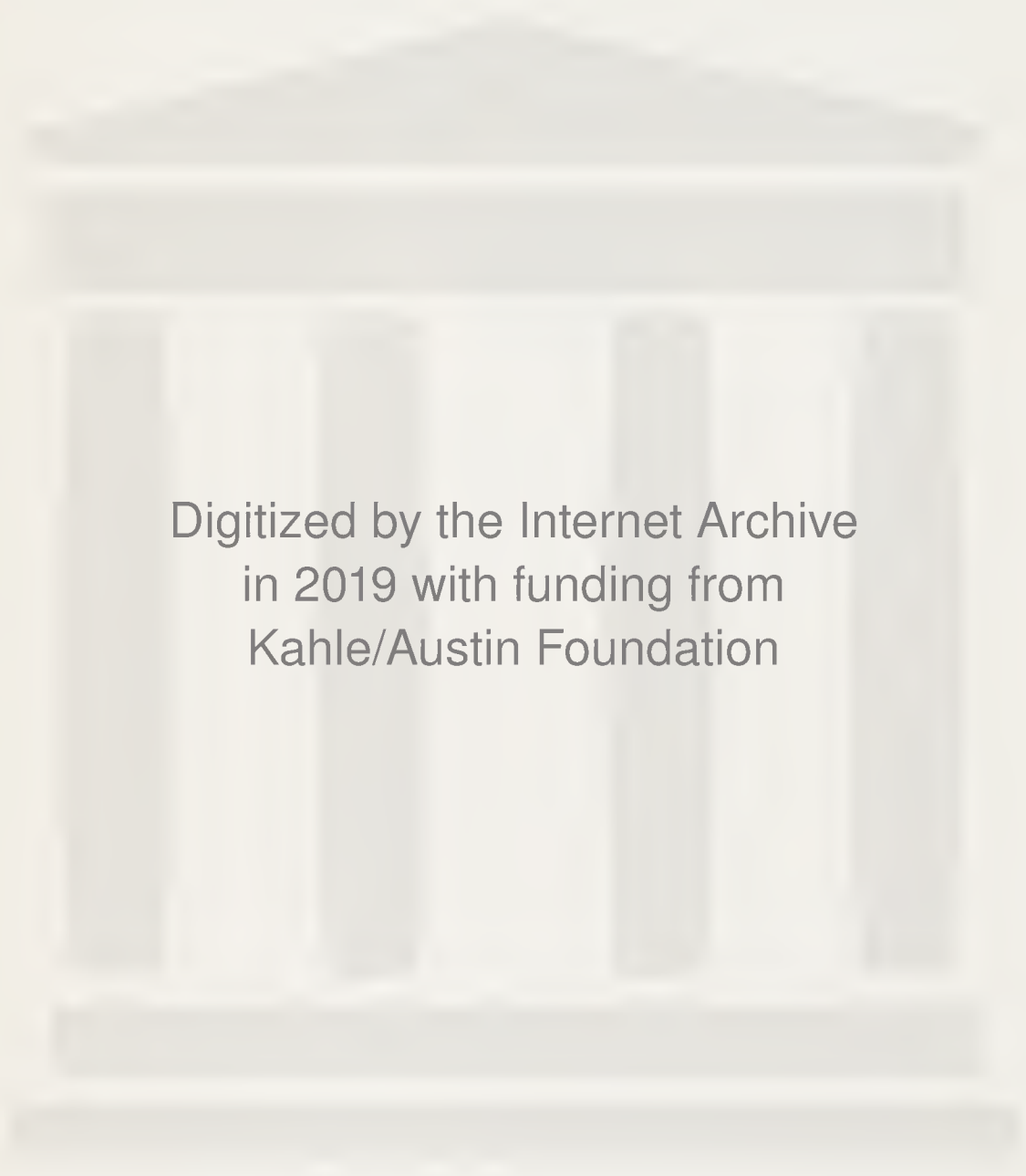


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TWENTY-SECOND ANNUAL REPORT

OF THE

BUREAU OF AMERICAN ETHNOLOGY

TO THE

SECRETARY OF THE SMITHSONIAN INSTITUTION

1900-1901

J. W. POWELL

DIRECTOR

IN TWO PARTS—PART I



WASHINGTON

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LETTER OF TRANSMITTAL

SMITHSONIAN INSTITUTION,
BUREAU OF AMERICAN ETHNOLOGY,
Washington, D. C., July 1, 1899.

SIR: I have the honor to submit, as Acting Director, the Twenty-second Annual Report of the Bureau of American Ethnology.

The preliminary portion consists of an account of the operations of the Bureau during the fiscal year; the remainder comprises two memoirs, prepared by collaborators, which illustrate the methods and results of the Bureau's work.

Allow me to express my appreciation of your constant aid and your support in the work under my charge.

I am, with respect, your obedient servant,

W J MCGEE,
Acting Director.

Honorable S. P. LANGLEY,
Secretary of the Smithsonian Institution.

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REPORT OF THE DIRECTOR

TWENTY-SECOND ANNUAL REPORT
OF THE
BUREAU OF AMERICAN ETHNOLOGY

J. W. POWELL, Director

INTRODUCTION

Ethnologic researches have been conducted during the fiscal year ending June 30, 1901, in accordance with the act of Congress making provision "for continuing researches relating to the American Indians under the direction of the Smithsonian Institution," approved June 6, 1900, and with the formal plan submitted June 9, 1900, and approved by the Secretary June 19, 1900.

The field operations of the regular corps extended into Arizona, British Columbia, California, Lower California (Mexico), Maine, New Mexico, New York, North Carolina, Ontario, Sonora (Mexico), Virginia, and Wisconsin; while special work has been carried forward by agents or temporary collaborators in several additional states, territories, and provinces. The office work has comprised the preparation and study of material from most of the states and territories, as well as from various other parts of the American hemisphere.

The researches have been carried forward in accordance with an ethnic system based chiefly on the work of the Bureau, though partly on the observations and determinations of other scientific investigators in this and other countries.

The ethnic system developed and adopted in the Bureau is based primarily on the human activities—that is, on what men do and think—rather than on mere physical features.

On this basis, the habits and customs of the aborigines receive first attention; and the tribesmen are classed by their languages and dialects, by their forms of social organization, by their systems of belief and opinion, and by their arts and industries; so that the classification affords a means of measuring the susceptibility of the various tribes to civilization, to education, and to arrangement on reservations in harmonious groups. The classification is thus essentially practical.

The practical tribal classification rests on a definition of the activities discovered among the aborigines and other peoples largely during the past quarter-century. The primary activities thus discovered are esthetic; and intimately connected with these are the industrial activities involved in maintenance and welfare. Equally important are the social activities shaping the collective existence of families, clans, tribes, and confederacies; and the relations are regulated by linguistic activities, which are highly important and indeed fundamental. Coordinate with these activities of arts and industries, laws and languages, are the activities connected with opinion, belief, philosophy—the sophic activities. On weighing all the factors it has been found that the most convenient classification of tribes is that based primarily on language, as explained in previous reports; and this mode of defining the Indian tribes, first proposed by Galatin and adopted by the Bureau on its institution, has now come into general use.

FIELD RESEARCH AND EXPLORATION

Throughout the first quarter of the year the Director was in Maine, reviewing observations on shell mounds and village sites in connection with the researches in classification noted in other paragraphs; and the work was resumed early in June. But limited collections were made, though the observations and notes on the numerous survivors of the Abnaki Indians proved of much interest and value.

An extended exploratory trip was made during the autumn of 1900 by Mr McGee. Early in October he proceeded to the field for the purpose of completing researches relating to the aborigines of the Serian stock and at the same time carrying forward studies of neighboring tribes. A party was organized at Phoenix, Arizona, and moved southwestward to Gila bend and thence southward to the international frontier at Santo Domingo. Here the outfit was admitted to Mexican territory through the courtesy of Señor Don Fernando Leal, at the obliging instance of Señor Don Manuel de Aspiroz, the ambassador from Mexico to the United States. In this vicinity are several settlements of Papago Indians, including some of the Areneños of early literature and local tradition, and the opportunities for study were seized. From Santo Domingo the party proceeded southward to Caborca and thence westward to the coast of Gulf of California, where the Tepoka Indians (collinguals of the Seri) were reported to live so late as 1894, subsisting on sea food and finding potable water in the lagoons and sand beds at the embouchure of the sand wash variously called Magdalena, Santa Ana, Altar, Asuncion, and San Ignacio. On reaching the coast the leader was disappointed to find the tribal remnant entirely gone—probably through extinction, possibly through migration down the coast to Seriland. Traces of the Tepoka habitations still remained, together with shell accumulations and minor relics, corroborating the reports concerning the tribe current at Caborca in 1894; and the visit served also to clear up doubtful points connected with the geography and history of the region.

Failing thus to attain the primary object of the expedition, Mr McGee determined to visit the territory of the little-known Cocopa Indians, reputed to live about the head of the gulf, and to this end endeavored to follow the coast northward to the mouth of the Colorado. Finding this entirely impracticable, he returned by a new route to Santo Domingo, collecting useful data concerning the Papago Indians on the way; and from Santo Domingo

he proceeded west-northwestward over the old Yuma trail (including a stretch of 90 miles now without water) to Yuma, and thence southward to the Cocopa country. Here valuable collections, notes, and photographs were obtained; and after some weeks the party returned via Yuma and the Gila and Salado valleys to Phoenix, disbanding there on December 20. The party comprised Mr W J McGee, Ethnologist in Charge, as leader; Mr DeLancey Gill, artist; Professor R. H. Forbes, of the territorial university of Arizona (during part of the trip); Señor Aurelio Mata, a Mexican customs officer sent from the custom-house at Nogales to facilitate the crossing at the international boundary; John J. Carroll, of Tempe, teamster; Jim Moberly, of Tempe, packer; Hugh Norris, of Tucson, Papago interpreter, and Ramon Zapeda, of Tucson, Mexican interpreter. The Bureau was placed under great obligations for free entry of the outfit to the government of the neighboring republic through the officers already named, as well as through Señor Don Eduardo J. Andrade, of Yuma, custodian of the Andrade grant, covering the territory occupied by the Cocopa Indians.

On August 11 Mr James Mooney proceeded to the old Cherokee country in western North Carolina and adjacent territory for the purpose of collecting additional data required for the completion of his series of papers on the Cherokee Indians, and his field operations continued with success until early December. On April 25 he made a reconnoissance trip through eastern North Carolina and Virginia for the purpose of locating remnants of aboriginal tribes still surviving in the wooded and nearly inaccessible districts of that region; he revisited the Pamunkey tribe and discovered considerable remnants of the Chickahominy, Mattaponi, and Nansemond tribes.

On his appointment as Assistant Ethnologist (September 1), Mr John R. Swanton proceeded to British Columbia to undertake researches among several northwestern tribes. His work proceeded successfully up to the end of the fiscal year, when he was still in the field.

On October 1 Mr J. N. B. Hewitt repaired to the region occupied by the survivors of the Iroquoian tribes in north-western New York and neighboring portions of Canada, where he began the collection and verification of traditions and cosmogonic legends, and his work continued until about the middle of February, when he returned to the office with valuable collections and records.

On April 15 Dr Frank Russell was appointed as Ethnologist, and was assigned to duty in Arizona; he immediately proceeded to the field and began an extended reconnaissance of the southern and central portions of the Territory. Outfitting with a team at Tucson, he passed around the northern end of Santa Catalina mountains and up San Pedro river (visiting the caves and pictographs of the Santa Catalina range and the cliff houses of the Galiuro range on the way) to Nugent pass, where he entered Aravaipa valley. Here he found an interesting group of cliff houses. Thence he proceeded by way of Eagle pass to Gila valley, where interesting archeologic observations were made. Pushing on southward he traversed the eastern slopes of Chiricahua mountains and the western slopes of Swisshelm mountains, and examined the easterly canyons of Huachuca mountains. Next he traversed portions of the Babacomori, Sonoyta, and San Rafael valleys about the Mexican boundary; thence he returned by new routes to Santa Catalina mountains and Tucson, arriving about the end of May. In the course of the trip he discovered various ruins hitherto unknown, some of new types. Several of the ruins were surveyed, and limited collections were made. On June 11 he proceeded northward from Tucson, crossing the Gila near Florence, skirting the base of Superstition mountains, and traversing Tonto valley; a number of cliff houses and other ruins were discovered during the journey, which was not completed at the end of the fiscal year.

In June an arrangement was effected with Mr O. P. Phillips and the Armat Motion-Picture Company, under which Mr Phillips proceeded to New Mexico and Arizona

for the purpose of making motion pictures representing the industries, amusements, and ceremonies of the Pueblo and other tribes, it being anticipated that such pictures would prove of especial service for purposes of immediate research as well as for permanent record. The preliminary reports indicate that the work has been successfully initiated.

Throughout the fiscal year Dr Willis E. Everett remained in Alaska, pursuing his vocation of mining engineer, but availing himself of opportunities for observing the native tribes and recording their languages and other activital characteristics. Several reports indicating progress in the collection of such material were received in the course of the year.

Dr Robert Stein, who spent the winter of 1899-1900 in Elsmere-land, primarily for purposes of geographic exploration, but incidentally to make search for traces of aboriginal occupancy in the interests of the Bureau, reported via Dundee, through the courtesy of masters of whaling vessels, late in the summer of 1900. He found no traces of Eskimo or other settlements in the territory traversed by him, comprising the eastern coast of Elsmere-land, and his negative evidence is of service in investigations relating to the distribution and migrations of the Eskimo. At the time of the last report he was preparing to cross Baffin bay to Upernivik, on the western coast of Greenland, with the expectation of extending his previous observations on prehistoric Eskimo settlements along the unexplored coast.

During the autumn Miss Alice C. Fletcher found it necessary to revisit Oklahoma for the purpose of completing the ritual of the Pawnee ceremony known as the Hako, of which the greater portion was collected during the last fiscal year. In connection with the collection of this material she was fortunate in obtaining also much additional information touching the ceremonial and ritualistic life of this highly interesting and little-studied tribe.

OFFICE RESEARCH

WORK IN ESTHETOLOGY

In addition to administrative duties in the office as Ethnologist in Charge and part of the time as Acting Director, and the field work noted, Mr McGee engaged in researches relating to the primitive symbolism found among the American aborigines and other lowly peoples. Certain symbols are of nearly world-wide distribution, and extend into several stages of culture—for example, the swastika, or filfot, appears on all of the continents except Australia, and its culture range extends at least from higher savagery into the lower strata of civilization. Before the extremely wide range of such symbols was ascertained various inquirers were led to regard their use as an evidence of cultural identity, and hence of the original unity of the peoples among whom they were found; but since they have been observed among highly diverse peoples in different stages of culture and on remote continents this interpretation has been modified or abandoned in large measure, and students have set themselves to the task of tracing the development of the symbols in particular cases. The recent researches have shown that symbols of quatern character, like the swastika, express or reflect modes of thought especially characteristic of lower (but not lowest) culture, yet extend well into civilization and enlightenment. At the same time the researches bring to light such diversities in the nature and applications of the concepts expressed by the symbols as to indicate, if not demonstrate, independent development. Thus, quatern symbols abound among the Papago Indians of Arizona and Sonora, as well as among several neighboring tribes, yet the Papago concept is distinct, as is shown by its extension to time as well as space, this extension carrying such archaic features of ritual and ceremony as to indicate increasing independence of the concept in the generations traced backward.

The neighboring Zuñi Indians have a more highly differentiated concept in that their "Cult of the Quarters" involves six directions (zenith and nadir in addition to the cardinal points), yet the symbol retains the original quatern form, with two added elements so placed as to destroy the symmetry of the figure. These instances of diversity in symbol, and still greater diversity in meaning of the symbol (or in the primary concept), might be multiplied almost indefinitely; they merely give some indication of the development of simple quatern symbols and of the complex and protean magma of thought out of which they have been developed by simple processes and easy steps. Incidentally the examples marshaled corroborate and extend the law of activital coincidences formulated in an early report of the Bureau; but the applications of the recent study are numerous and useful, especially in their bearing on symbolism in general and on the development of systems of counting. The results of the study are incorporated in the Nineteenth Report in the form of a brief paper entitled "Primitive Numbers."

During the earlier portion of the year Dr Fewkes arranged for publication a series of graphic representations of the personages composing the Hopi pantheon, together with full descriptions of the pictures and a discussion of characteristic paraphernalia of the personages represented. The representations are in outline and color and well illustrate the early stage in the development of graphic art reached by the more advanced among the aboriginal tribes; hence they throw strong light on the codices and other pictorial essays of the more southerly tribes, especially those of Mexico, Central America, and Peru. The pictures were executed by a native artist, who was also a priest in the hieratic or sacred organization through which the tribal mythology is maintained, and each picture is a faithful reproduction of ancient representations handed down through many generations. The material has been published in the Twenty-first Annual Report, the original drawings being used as copy and

reproduced in slightly reduced facsimile. The work is deemed an important contribution to knowledge of the aborigines in several respects. It illustrates the motives and conventions of aboriginal art in both form and color; it reveals the rôle of symbolism in primitive art with remarkable clearness; it illustrates with satisfactory completeness the nature and structure of a typical barbaric pantheon; and since the symbols and conventions (and, indeed, the personages represented) are of great constancy in primitive thought, it affords a series of types available for use in identification and comparison of a wide range of symbolic representations among the Pueblo and other tribes, not only in ceremonies and sacred paraphernalia, but in the decoration of fictile ware, basketry, woven fabrics, etc.

Later in the year Dr Fewkes was occupied with a systematic study of the collections made by him in Arizona and New Mexico during 1896 and 1897, the study being carried forward with special reference to the symbolic decoration of the fictile ware. All systematic investigators of the decorative devices used by primitive peoples have been impressed by their constancy, that is, by the exceeding slowness of modification. They have also been impressed with the dependence of the modification on external forces and conditions rather than on the spontaneous internal factor so prominent in the art of advanced culture. Recognizing these characteristics of primitive art, Dr Fewkes undertook to define the symbolic (or esthetic) types prevailing among the peoples of Walpi, much as a naturalist might define types of animal and vegetal life for the establishment of species and genera and orders, and for tracing the lines of vital development in a distinctive environment. His symbolic types were based on specimens observed among the tribesmen or obtained from sites occupied by their ancestors during the historical period; and he soon found that the types served to indicate what may be termed a symbolic province, that is, a region throughout which the symbolic devices were

similar, but in which they differed essentially from those of other regions. In this way he defined an ethnic district and established standards for the guidance of future investigation and also for the localization of ill-labeled specimens in museums; for many collectors have been content to label specimens of symbolic pottery and other objects "Arizona," "Pueblo region," or by other large and indefinite political or natural divisions, thereby confusing important symbolic distinctions and ethnic districts.

As his investigations of the symbolic types progressed, Dr Fewkes became more deeply impressed than any predecessor with the persistence of motives and the regularity of their evolutionary lines; and he conceived, in a definite and constructive way, the possibility of tracing prehistoric migrations by means of the decorative symbols, that is, of employing symbolic devices as prehistoric records, reading from them the tale of tribal movements before the coming of Coronado—he conceived the possibility of coordinating the archeologic record as taught by symbols with tribal traditions, and the double advantage of mutual verification between tradition and symbolic record. Proceeding in accordance with these ideas, he obtained from living Hopi men traditions of a former residence of their ancestors at a locality which they called Homolobi, and by excavations he identified this site and verified the traditions, thereby extending his knowledge of the evolution of the symbolic types; for the Homolobi collections (now in the National Museum) not only abound in decorated ware, but are notably rich in symbols susceptible of interpretation. Subsequent exploration brought him to the site of a ruin on Cheylon creek, where excavation revealed another stage in the same general line of symbolic development, which corroborated the vague and shadowy tradition that Hopi clans once inhabited this site. He later sought a locality noted in still vaguer migration legends, and was gratified by finding near Chaves pass the archeologic record of this stage in migration inscribed

in symbols related to the higher type from the more northerly localities.

Beyond this point ruins which mark traditional halting places in migration were not located; beyond it the symbolic development has not yet been traced; but there is good ground for anticipating that when Dr Fewkes returns to the field he will obtain still earlier records of the prehistoric movements and development of this branch of the Pueblo peoples. The work is deemed of much importance as a verification of aboriginal tradition, as a means of verifying other migration legends, and as a promising introduction to the practical interpretation of history unwittingly recorded in graphic symbols. Incidentally, the work corroborates the earlier conclusion reached in the Bureau, that the Pueblo peoples are a resultant product of Southern culture and Northern blood; yet the significant details throw new light on the entire problem. The report is elaborately illustrated by colored photographs of the ware from the several localities examined; it occupies a portion of the present volume.

WORK IN TECHNOLOGY

The earlier accounts of exploration in the territory occupied by the Cocopa Indians seemed to indicate that the tribesmen occupied the coast of Gulf of California and were of maritime habits; but in the course of the expedition led by the Ethnologist in Charge it was definitely ascertained that the folk are essentially agricultural and confined, at least so far as habitations are concerned, to the interior. The industrial condition of the tribe was found to be of much interest. The tribal habitat comprises the Lower Colorado valley from the International Boundary southward to the head of the gulf, together with a few tributary valleys descending from the Cocopa mountains on the west. The main valley is broad and diversified by distributaries, or bayous, of which the most important is Hardy river, or "Hardy's Colorado." There are also several fairly permanent basins, filled by the

annual floods and slowly evaporated during succeeding months, and the greater part of the broad bottom is swept by the freshets. Within the region lie a number of "mud volcanoes," apparently analogous to the "mud lumps" of the Lower Mississippi, which have attracted much attention by reason of their novelty, though they are quite subordinate to the general features. The entire district affords the closest American parallel to the valley of the Nile, not only in physical conditions, but in the influence of these on human conditions.

Like northern Africa, the general region is one of extreme aridity, the rainfall (averaging less than 2 inches yearly during the last quarter-century at the typical station of Mammoth Tanks) being negligible; while the habitable district is well watered by annual freshets of remarkable regularity in period and height. These freshets not only flood but fertilize the riparian lowlands; they control directly the local flora and somewhat less directly the local fauna, and they regulate the movements, most of the industrial habits, many of the social customs, and much of the mythology of the human population. During the greater part of the year water is obtainable only from the shrunken river, on whose banks grow most of the seed-bearing and root-yielding plants available as food, so that the people are led to occupy the lower bottom lands. Here the cultivated crop plants are sown in soil soaked by the flood and enriched by its silt deposit, to grow and ripen rapidly under the subtropical sun; here habitations are erected, naturally of light and temporary character, and here the small and scattered villages characteristic of the tribe grow up during each late summer and early autumn. The chief crop plants are corn (maize), beans, peas, squashes, and melons, and it is noteworthy that most of these represent the aboriginal plant stocks brought under cultivation in pre-Columbian times.

Fishing and hunting the abundant waterfowl, as well as other game, contribute to the tribal subsistence, and during recent years part of the crop of corn, beans, and peas

is carried on horseback to Yuma and bartered chiefly for appareling. Early winter is the time for ceremony with the attendant feasting, and by early spring, when the greater and less portable part of the annual crop is consumed, the families prepare for the annual migration to the higher lands, where they await the rise and subsidence of the vernal flood. On its passing they return to the low grounds, to rebuild and plant on the last year's farms or elsewhere according to the changes wrought by the freshet or the chance of death and mortuary observance. Naturally an agriculture depending so largely on chance conditions is improvident, comparatively unproductive, and incapable of sustaining any considerable or concentrated population, so that its tendency combines with that of annual migrations to stifle the home sense and to scatter the members of consanguineal groups, and thus to affect the social organization. The recurrent floods also affect the ceremonies and attendant faiths of the tribesmen in various ways; for example, they control mortuary observances and have undoubtedly led indirectly to the custom of burning the bodies of decedents in and with their houses, distributing their property to nonrelatives, and incidentally destroying adjacent houses and other property. This dispersive social factor combines with that growing directly out of the agricultural methods, and not only prevents the development of village life with the concomitant institutions, but perpetually impoverishes the tribe. Thus the Cocopa Indians present an industrial paradox, for while they occupy one of the garden spots of the Western Hemisphere, whose natural freshets might be so utilized as to sustain an enormous population, they subordinate themselves to the environmental conditions and remain one of the poorest and most hopeless of the American tribes.

During the earlier part of the year Dr Albert E. Jenks (then a correspondent of the Bureau) revised his memoir on "The Wild Rice Gatherers of the Upper Lakes" (published as part of the Nineteenth Annual Report), incorporating some of the results of recent researches. On

June 1 he was appointed to the position of Assistant Ethnologist in the Bureau, and was assigned to work related to his previous researches. He at once took up the subject of birch bark, with the aboriginal industries depending on this natural commodity of a considerable fraction of the North American continent. One of the most important products of the birch-bark industry is the canoe; and this, like other industrial products of consequence, exerted a powerful influence on the lives of the producers. Through one of those harmonies of nature on which the progress of mankind so largely depends, much of the birch-bearing region of North America (a zone stretching from Maine to Washington State and Alaska, and extending from below the Great Lakes nearly to the treeless Arctic) is also the region of late Pleistocene glaciation, and hence of glacial lakes, swamps, and labyrinthine streams; so that throughout the period of aboriginal development an ideal canoe material coexisted with illimitable functions for the canoe in the way of travel and transportation.

Under the natural combination, aided by native intelligence and skill, the lakes and streams became routes of passage, and by reason of the lightness and strength of the material, and the lowness and narrowness of the ice-molded divides, portages were easy, so that the routes passed from lake to lake, river to river, and drainage system to drainage system, practically across the continent. Under the stimulus of facility, the birch-canoe makers became travelers and explorers; energetic hunters and fishermen explored new waters and carried tribal knowledge into new regions; ambitious scions struck out into the remoter wilderness to make conquest over the unknown and often to establish families and clans, and eventually tribes, in new localities; so that in course of time the paddlers of the light canoe carried their kindred, their dialects, their faiths, over the greater part of the vast region defined by the birch tree and the glacial waterways. Most of the canoemen belong to the Algonquian stock, most of the remainder to the Athapasean stock; and the recent

researches render it clear that their water craft was a leading factor in determining their wide distribution and their success in making conquest of the continent up to the plane of aboriginal standards. The detailed results of the work are in preparation for an early report.

In tracing the joint lines of migration and esthetic development noted in other paragraphs Dr Fewkes became impressed with the fact that among the ancestors of the Hopi Indians the esthetic standards were much more permanent than the industrial standards. Throughout the entire course of tribal migrations retraced by his researches—a course covering several distinct treks, alternating with periods of stable settlement, the whole covering some centuries—the symbolic devices inscribed on the fictile ware remained constant or underwent only slight and easily traceable modifications, while at each successive settlement new materials were utilized in the pottery making, the manufacturing processes and the final forms of the ware being manifestly adjusted to the character of the material. The discovery that the industrial activities (which directly measure the conjuncture of man and environment) are the most progressive of the entire series is not, of course, novel; still less is it novel to learn that the especially conservative esthetic concepts, which are at once hereditary and prophetic, as shown by Groos, outlive whole generations of contemporaneous industrial concepts; yet the example is notably apposite and instructive, largely by reason of the freedom of the folk from external interference, with the consequent simplicity and integrity of the record. The details are incorporated in Dr Fewkes's paper in another part of this report.

In the course of his reconnoissance of central and southern Arizona Dr Frank Russell gave especial attention to the architectural features of the ruins, and defined a number of types, of which one or two are new to southwestern archeology. The work was still in progress at the close of the fiscal year.

WORK IN SOCIOLOGY

A portion of the year was employed by the Director and the Ethnologist in Charge in reviewing the abundant data in the Bureau archives relating to aboriginal institutions, and in systemizing the principles of sociology in the light of these data. One of the lines of inquiry, rendered important not only by inherent interest but by current problems growing out of the recent expansion of the territory of the United States, relates to slavery among the primitive peoples, and the researches render it clear that the relationships so designated vary widely with intellectual plane or culture grade—indeed, the social subordination of lower culture is so unlike the slavery of civilization that the application of the same designation to both institutions is quite misleading. In the slavery of civilization the slaves are not only aliens but chattels, personal ownership of whom is definitely established and maintained through laws relating to tenure, bequest, conveyance, etc., but in savage society, in which personal proprietary rights are inchoate or non-existent, in which the tenure inheres practically or absolutely in the group, in which bequest is hardly, if at all, recognized, and in which thrift sense is lacking and property sense involved with mythic factors, such slavery is simply impossible. True, there are many recorded instances of slavery among lower tribes, but most of these rest on casual or superficial observation, or on other testimony stopping short of inquiry into the precise nature of the relations between the supposed slaveholders and the supposed slaves, while the convenience of the common term for the expression of social inequality has contributed to mislead recorders and (still more seriously) readers.

To understand the so-called slavery of savagery it is necessary to grasp the mode of social organization characteristic of that culture grade. As shown chiefly through the researches among the American aborigines, such organization is based primarily on consanguinity (actual

or imputed), and secondarily on age; and the relations growing out of these factors are kept constantly in the mind of every member of each clan and tribe by habitual forms of address. So the constituent individuals of a given clan are fathers and mothers, sons and daughters, brothers and sisters, and these relationships are constantly indicated in salutations, and even in ordinary conversation (the precise relationship to the speaker being commonly expressed also by a pronominal element). At the same time it is constantly borne in mind that father and son, mother and daughter, are not coordinate, the former being the superior by reason of greater age; similarly brethren are classed as elder brothers and younger brothers, while the female kindred of the same generation are classed as elder sisters and younger sisters, and the elder are always deemed superior, the younger inferior, in rank. By simple and practical extension of the system, the relative ages of all persons in the clan are kept in mind; and since, according to the universal usage of savagery (so far as known), superior age confers authority, there is a practically simple, though theoretically complex, regimentation running through the entire clan, whereby the eldest person commands all and obeys none, while the youngest person obeys all and commands none, and each other person is entitled to command and bound to obey in the direct proportion of relative age. This regimentation is complicated by various factors, such as adoption, and (especially) what may be called promotion and demotion, that is, advancement in "age" (rank) by common consent in recognition of prowess, etc., with correlative reduction in "age" as the penalty for cowardice, etc., so that the actual age relations may be completely lost; yet the imputed relationship serves practical purposes, and the organization is maintained with unimpaired efficiency by means of relationship terms. The same system is extended from the clan to the tribe, in which the several clans are ranked in the order of "age" (of course imputed), and eventually to the tribes united in confederacies; so at last

the system reaches every member of the tribal confederacy and each is entitled to command or bound to obey any other according to the relationship expressed in the form of salutation and constantly kept alive in conversation. True, uncertainties and differences of opinion may arise, especially between the remoter individuals and groups; commonly these are settled by more or less prolonged deliberation and discussion, or "council," though some of the bloodiest wars of Indian history grew out of such misunderstandings; yet even the appeal to force and arms but serves as a means of settlement of the dispute, for the conquerors thereby become the elder and the conquered the younger in primitive thought. So, too, when stranger tribes meet, both are constrained by universal tribal law, and proceed to council or war, as the case may be, for the purpose of fixing the relative "age," with the consequent right of command, and in some cases the question may remain open for centuries (as between the Apache and the Papago) and lead to interminable warfare. Now, the conquered tribe may merely retire from the field of dispute, leaving what both conceive to be the verdict of superhuman potencies beyond reach of continuous execution; but if the contestants are actually related, or if the conquest is complete, they commonly remain in association, the survivors of the conquered families being absorbed or more formally adopted into the conquering tribe, and perhaps distributed among the families of that tribe, whereupon all the captives become subordinate to each and all of the conquerors, to whom thenceforth they owe obedience. Commonly it is this condition of obedience on the part of a certain class or group to the commands of another class or group which impresses observers and leads to the records of slavery among primitive folk, though the institution involves no ownership of human chattels, no rights or duties save those connected with a system of rank correlated with relative age, actual or imputed. The institution might better be styled wholesale adoption, or collective adoption, than slavery. Among the American aborigines the

captives, or adoptees, are usually assigned an "age" corresponding with the time of their entry into the tribe, so that they are compelled thereafter to obey all children then living, and are entitled to command all children subsequently born into the tribe, and there is thus a fixed way whereby they attain in time the rank of the conquerors. Moreover, the method of promotion permits any "slave" (that is, captive-junior) to attain "age" by the display of prowess, industry, skill, generosity, or other attributes appealing to the sentiments of primitive men. Among certain other peoples, the custom of collective adoption appears to be so modified that the captives remain juniors not only to members of the captor tribe born anterior to the captivity, but to all others, and it is this modified institution which matures in actual slavery with the development of property-sense; but even in this case there are (at least in the early stages) devices for the manumission or liberation of, or the acquisition of rank by, captives (or captive-descendants) of exceptional abilities. The several primitive customs grade into the institution of slavery proper in ways which are of much interest, but which need not now be followed; it suffices to emphasize the important distinction between the captive subordination of primitive peoples and the real slavery of some civilized nations.

In the course of his researches among the Cocopa Indians Mr McGee discovered several industrial factors of dispersive tendency, that is, factors tending to weaken home ties and family bonds and to scatter the families and clans; and naturally these factors are reflected in the social organization. The tribe is now distributed over an area of several thousand square miles, extending from the International Boundary on the north to the head of salt water (of Gulf of California) on the south, and from the eastern border of the Colorado bottom to the base of Cocopa mountains; and within this area are seven subtribes, of which some, and perhaps all, are really clans, each organized under a subchief and all definitely united under a head chief, the present incumbent of this

office being a man of parts, an orator of ability, and a leader of much shrewdness, commonly known as Pablo Colorado. Now, naturally (and necessarily for the maintenance of tribal integrity) the dispersive factors are counteracted and balanced by connective factors; and while it is probable that some of these remain undiscovered, a few of no small significance were detected by Mr McGee. As has been mentioned, the mortuary observances include sacrifice of all the immediate belongings of decedents, for immediately after the death of a tribesman his personal possessions—horse, saddle, weapons, implements, apparel, grain and other food stuffs, bedding, dogs, etc.—become public and are distributed among nonrelatives in the order of arrival, while any unclaimed residue is burned with the body and house. Several social consequences attend this industrially improvident procedure. In the first place, the largess is an incentive to maintaining connection between the scattered families and clans and to lively (albeit morbid) interest in the state of health of invalids, thrifty producers, and other members of the tribe; again, the actual mortuary distribution brings together scattered tribesmen and their families and unites their interests in ceremonies of affecting if not imposing character; and finally the material sacrifice commonly leaves dependents (widows, children, and perhaps agelings) to be supported by the informal public bounty of tribal life, or perhaps to be distributed among scattered families in such manner as to strengthen sentiments of communality and to keep alive the sense of community in interests. This factor is prominent in the customs of the tribe, and its influence is direct and easily traceable.

A less direct factor of similar tendency is found in the marital customs, or rather in the observances preceding and preparing the way for marriage. The girls' puberty feast is, indeed, one of the most imposing and widely heralded of the tribal ceremonies; commonly it brings together representatives of all the subtribes or clans; and the proceedings are conducted with extreme formality

and dramatic impressiveness. The principal ceremony lasts through a night, following a day of preparation and followed by another day of final feasting, accompanied by games, etc. The central episode is the temporary burial of the novitiate; a shallow pit is excavated, and in this a fire is made, as for a fish bake; after the earth is thoroughly warmed the remaining fuel and coals are removed, the girl is placed in the pit and buried to the neck with the earth thrown out in making the excavation; there she spends the night, and in the morning is extricated and brought before the assembled tribesmen as a woman; and commonly a match is made with a representative of some more or less remote branch of the tribe. Through the ceremony community of thought is maintained in most effective fashion, and through the resulting marriage the two families are united to the extent that a common consequence is the breaking of a new path, often many miles in length, through the luxurious herbage of the annually flooded bottom land. The formal organization of the Cocopa tribe is in large measure esoteric, so that it can be ascertained fully only after prolonged and intimate acquaintance with the tribesmen, but the preliminary investigation serves to show that the field of inquiry is one of promise.

In his comparative study of myths Mr J. N. B. Hewitt found various references to social customs of such sort as to indicate clearly certain archaic institutions of the Iroquoian Indians. Thus the Onondaga legends illumine the legislative and executive customs of the tribe, and, while ostensibly giving traditional warrant for the customs, they really picture a somewhat earlier stage in the development of institutions than that found by the Caucasian pioneers. In this tribe all matters of public policy, especially the selection of chiefs and the discontinuance of war, were first considered by the elderwomen in fairly definite clan councils. Their conclusions were formally communicated to a male spokesman, usually the elder brother (actual or putative) of the elderwoman, and by

this spokesman, with others of similar character from the other clans, the opinions of the mothers were brought before the exclusively masculine tribal council for debate and final decision. In this way the women sitting in clan council constituted the primary legislative body, while their brothers sitting in tribal council formed a senate or final legislative body whose decisions were binding on the executives of clans and tribes; so that the social organization may be classed as adelphiarchal (like that of the Seri Indians described in earlier reports) in principle, though largely patriarchal in detail. As among the Seri, too, the maternal features of the legislation were paralleled by recognition of large maternal rights in material possessions—for example, throughout the Iroquoian tribes the control or nominal ownership of lands was in the women as the collective and perpetual mothers of the tribe. These and other points of general interest are set forth in Mr Hewitt's memoir, which was assigned to the Twenty-first Annual Report.

WORK IN PHILOLOGY

Throughout a considerable part of the year the Director was occupied in developing and applying the system of linguistic classification foreshadowed in the last report. Primarily, languages are devices for the expression of thought; secondarily, they are mechanisms for shaping thought. The simplest languages are emotional and largely demonstrative, comprising not only articulate vocal utterances, but inarticulate sounds, gestures, facial expressions, etc., and these spontaneous expressions of feeling and thought grow into the four leading lines of linguistic development. The simplest of these is gesture language (or sign language), which arises largely in pantomime, but matures under favorable conditions in highly complex systems such as those investigated by the late Colonel Mallery and more recently by Major H. L. Scott (whose studies were unfortunately interrupted by the Spanish-American war). A far more important line of

linguistic development is that of oral speech, and the activities of expression have been so long and so vigorously exercised in this line as to have developed a series of special organs differing widely in refinement of function and delicacy of structure from those of lower animals. By means of these organs the speaking animal, Man, gains mastery of sound, which is created at will and reduced to vocables, tones, and sentences in such manner as to convey ideas of the utmost complexity with hardly perceptible loss of meaning; and with the development of words and sentences lexicology and grammar arise, while etymology and sematology gradually acquire importance. The third line of linguistic development is that of written language, which first involved manual adaptation, together with a revolution in mode of thought, and afterward involved the invention of that long series of mechanical devices now forming the sign and measure of higher intellectuality. The last line of linguistic development is that represented by characters expressing quantitative values; it may be styled logistic language. Although based primarily on the rich records of aboriginal American languages preserved in the archives of the Bureau, the system of linguistic classification was shaped by extended comparisons with the various languages of Europe and Asia, together with some of those of Australia, Africa, and Polynesia. The system was freely discussed with students and published in preliminary form for the purpose of eliciting further suggestion and criticism; the matter was incorporated in full in the Twentieth Annual Report.

In connection with the linguistic classification, the Director continued to study the recorded languages of the Mexican and Central American tribes, with a view to classifying these tribes by linguistic affinities in a manner corresponding to that already adopted for the American tribes north of Mexico (the classification being published in the Seventh Annual Report). In this work he had the constant assistance of Dr Cyrus Thomas, whose familiarity with the literature of the southern districts of North

America proved invaluable. Before the end of the year a preliminary classification was made and mapped; but it is deemed unwise to submit the matter for publication pending reexamination of various critical points. It has been the good fortune of the Bureau to see its classification and mapping of the tribes north of Mexico adopted widely, and it is naturally desired that the continuation of the work southward shall be equally worthy of acceptance.

Dr Albert S. Gatschet continued the arrangement of the comparative Algonquian vocabulary, and also carried forward his analysis of the complex structure of the Peoria language. In both directions his progress was considerable and his results of much value, not only as an aid in formulating the linguistic classification above described, but to the collaborators of the Bureau and students generally.

Dr Franz Boas continued the arrangement of linguistic material for publication at intervals throughout the year. In addition, he revised the proofs of his memoir entitled "Kathlamet Texts," submitted just before the close of the last fiscal year and transmitted for publication in bulletin form early in the present year. By reason of the highly technical character of the matter, composition was necessarily slow and proof reading laborious; but the matter is now all in type.

The Natick Dictionary, compiled from the Eliot Indian Bible by the late James Hammond Trumbull (noted in the last report), is still in the printer's hands, though nearly ready for publication.

In connection with the collection of Iroquoian myths, Mr Hewitt has continued recording the vocables and working out the grammatic structure of the languages spoken by several Iroquoian tribes. Some of the results of the work appear in his memoir on comparative mythology in the Twenty-first Annual Report of the Bureau; others are in condition for incorporation in future reports.

As already noted, Mr John R. Swanton spent the entire year in collecting linguistic material in British Columbia.

The languages of this district give promise of special importance in their bearing on questions of tribal migrations and intertribal relations. Mr Swanton has not yet taken up the preparation of his material for publication.

The work on the *Diccionario de Motul*, described in the last report, is still under way. A considerable portion of the manuscript in Maya and Spanish was transcribed by Miss Jessie E. Thomas during the year, and Señor Audomaro Molina, of Merida, Yucatan, is engaged in furnishing an English translation and in extending the vocabulary through personal acquaintance with the Maya tongue.

WORK IN SOPHIOLOGY

As has been indicated by the contents of previous reports, the Director has for some years been engaged in developing a system of anthropologic classification designed primarily to serve as a basis for the researches in the Bureau, though it is hoped that the system will be of use to the students of the Science of Man throughout the world. It was the partial development of this system that led first to discrimination of the human activities and later to the definition of the five groups of activities observed in the researches and described in recent reports. During the last five years several of the groups or categories of activities have been formulated and characterized with some degree of fullness. The treatment began with the arts, or esthetic activities, and proceeded to the industries, or technical activities, and thence to the institutions expressing social activities. During the past year the characterization was extended to languages, or the activities designed for expression, as already set forth, and toward the end of the year the last and most complex of the activital groups, that is, the sophic activities involved in opinion, together with myth, faith, and the more refined and ennobling products of mentation, was taken up. Fair progress was made in the analytical work.

During his Southwestern expedition Mr McGee found opportunity to witness certain ceremonies of the Yaki Indians, which were of interest partly because the tribe has been little studied, partly by reason of the prominence of zoic motives in the vocalization and instrumentation, as well as in the gestures and movements of the ceremonial dance. In portions of the ceremony each actor impersonated an animal. He wore a headdress (not extended into a mask, as among more northerly tribes) consisting of a scalp, with ears, horns, and other appendages of the animal kind, and leggings abundantly decorated with claws or hoofs of the same animal. He carried a rattle or flute, used to imitate the voice of the tutelary or the sound of its movements, while he imitated its notes of alarm, fright, pain, and pleasure with his own voice; and mimicked its corresponding movements; yet in other parts of the ceremony the same actors passed by carefully graded stages into the strictly conventional movements of a dance involving collective action of considerable complexity. Briefly, the ceremony seemed to be characterized by a remarkable combination of symbolic and conventional features, indicating an exceptional range from the primitive impersonation to the formal figures and movements attending moderately advanced culture.

Mr James Mooney continued his researches relating to the mythology of the Cherokee Indians, making good progress in the collection of additional material in the field, as well as in the extension of comparisons between the myths of the Cherokee and those of other tribes and peoples. The application of comparative study to primitive mythology is proving highly instructive and useful. In the infancy of ethnologic research students were frequently struck by the discovery of activital parallels, or similarities, among more or less remote peoples, and were led thereby to infer previous contact, or even closer relationship, between the peoples; but as study progressed and new parallels were discovered, even among the remotest peoples of the earth, the verity of the inference came to be questioned, and finally the law of activital

coincidences was formulated as a convenient generalization of the facts connected with independent development of devices produced in the constant adjustment of the intelligent organism to its environment. At first the law of activital coincidences rested chiefly on industrial artifacts; then it was found to have equal support in the esthetic products of various peoples; next it was found to have still stronger and more direct support in institutions, in the devices and features of social organization; while certain features of language were found also to indicate the extent and efficiency of coincidental interaction between mind and nature in shaping the activital products. Hitherto most investigators of mythology have been content with discrete studies and explorations, or, at most, with exoteric parallels. Accordingly many of them have stopped with the inference of former contact or kinship on which the students of industrial artifacts rested a quarter century ago, that is, their studies were such as to bring out resemblances among the mythic systems examined, but not such as to detect and properly emphasize the essential differences. Now, Mr Mooney's comparisons, although not exhaustive, are sufficiently general to permit discrimination of the exoteric coincidences from esoteric motives in the myths. Accordingly they clear the way for the application of the law of activital coincidences to primitive mythology, if not to sophiology in general. The greater part of the material completed for publication has been incorporated in the memoir on "Myths of the Cherokee," published in the Nineteenth report.

Another comparative study of myths has been carried forward by Mr J. N. B. Hewitt; and this investigation is noteworthy in that the comparisons are confined to a limited group of confederated tribes (of the Iroquoian stock) and in that the features compared are in exceptional degree esoteric. The myths were obtained at first hand and carefully recorded and verified in the aboriginal terminology, after which literal and free translations were made, so that each chapter of the work is at once a

linguistic record and the best obtainable version of the ancient traditions. Now, it is noteworthy that most of the similarities found thus among the several Iroquoian myths are rather external than internal, rather superficial than essential, and, concordantly, that the more important differences are primarily internal, that is, more directly connected with concept and motive than with ritual and emblem. The voluminous material was practically ready for the press at the close of the fiscal year and was assigned to the Twenty-first Annual Report.

During the closing months of the year Dr Fewkes was employed in summarizing his own observations and those of others in the pueblo region, with the object of presenting an outline of Pueblo mythology. As noted in earlier reports, the pueblo region is arid, and hence infertile and harsh as an environment for human inhabitants, and the harshness of environments is curiously reflected in highly differentiated beliefs and ceremonies, so that the pueblo region as a whole may, perhaps, be regarded as a sophic province, that is, a province defined by a distinctively typical series of myths and faiths. Good progress was made in the work, which was not, however, completed at the close of the fiscal year.

In addition to the inquiries connected with the classification of the languages of Mexico and Central America, Dr Cyrus Thomas gave continued attention to the hieroglyphic records of the inscriptions and sculptures of Yucatan and interior Mexico, materially supplementing and extending his paper on calendric systems published as a part of the Nineteenth Annual Report. He made some progress also in the preparation of a final memoir on the codices.

Although seriously handicapped by ill health, Mrs Matilda Coxe Stevenson continued the preparation of her memoir on the ceremonies and myths of the Zuñi Indians. A portion of the manuscript was submitted for editorial revision in May, and the remaining chapters were reported as nearing completion at the end of the fiscal year.

As noted in the last report, an exceedingly valuable acquisition was made through Miss Alice C. Fletcher in the form of the Pawnee ritual known as the Hako; but on arranging the material for printing certain breaks were found which seemed of such importance as to warrant postponement of publication pending further efforts in the field to complete the ritual. Accordingly Miss Fletcher revisited Oklahoma, and afterward brought her principal informant to Washington, where the record was finally made perfect. The ritual is remarkable for extent and fulness, for the clear light which it throws on archaic customs and beliefs, and for the systematic and harmonious development of the musical and terpsichorean features. The original record was obtained by aid of the graphophone, and this record was then written in words and musical notation, and afterward verified by repetition. On the whole the ritual is one of the most complete ever acquired by the Bureau, and is in every way worthy to be regarded as a type of aboriginal ritualistic production. The final arrangement of the material was nearly finished at the close of the fiscal year, when the work was interrupted by Miss Fletcher's temporary absence from the city.

WORK IN DESCRIPTIVE ETHNOLOGY

During the earlier portion of the year Mr F. W. Hodge continued the preparation of the *Cyclopedia of Native Tribes* in connection with editorial work, his progress in both lines being highly satisfactory. On January 31 he resigned his connection with the Bureau to accept a position in the office of the Secretary. The *Cyclopedia* material was then turned over to Mr Mooney, who has made some progress in preparing it for publication.

During the earlier months of the year Colonel F. F. Hilder was, by temporary transfer, engaged in making collections in the Philippine Islands under the auspices of the Government Board of the Pan-American Exposition. After his return he resumed his duties as Ethnologic

Translator and continued the transcription, translation, and annotation of an early Jesuit manuscript history of Texas, obtained through the instrumentality of the Bureau, but now preserved in the Library of Congress. The sketch was found rich in important ethnologic data, and the anonymous author was identified by Colonel Hilder, through collateral information, as Padre Morfi. The work was nearly completed when brought to a premature end by the sudden death of Colonel Hilder on January 21.

PUBLICATION

Mr F. W. Hodge continued in charge of the editorial work until his resignation took effect, as already noted, after which this work was conducted by Mr H. S. Wood. The first part of the Seventeenth report and the first part of the Eighteenth report were received from the Government Printing Office during the year, and these, with the second part of the Seventeenth report, have been distributed. The second part of the Eighteenth report was not delivered at the end of June, while neither of the two bulletins of the new series was quite complete; and the Nineteenth report, though nearly all in type, was not yet ready for the bindery at the close of the year.

Mr De Lancey Gill remained in charge of the illustrative work, preparing copy for and revising proofs of the numerous illustrations for the Eighteenth and Nineteenth reports. He also made photo-portraits of some two hundred Indians, chiefly members of delegations visiting Washington in the interest of their tribes, and developed a considerable number of negatives made by the several collaborators in the field.

COLLECTIONS

As usual, the several collaborators engaged in field operations made more or less extensive collections for purposes of study and for ultimate transfer to the U. S. National Museum. The largest collection of the sort was made by Mr McGee among the Cocopa Indians. It com-

prised domestic utensils of wood, stone, and clay; several bows with arrows; war weapons; complete suits of women's apparel; cradles; decorative and symbolic objects of shell and bone; flutes, rattles, etc., together with the chief vegetal food products used by the tribe, the collection being sufficiently complete to permit the construction of one or more life-size groups. The most elaborate war weapon is of interest in that it is designed to serve at once as standard and spear, and in that the sharpened point for the latter use is at the inner end of the shaft, so that the weapon illustrates the centripetal movement of lowest culture rather than the centrifugal arm movement characteristic of advanced culture. Smaller collections were made by Mr Mooney among the Cherokee Indians, by Mr Hewitt among the Iroquoian Indians of Canada, and by Dr Russell in Arizona. A number of collections were obtained also by purchase under the more immediate direction of the Secretary. Among these may be mentioned the Steiner collection of stone implements from Georgia, which comprises a large number of types and of which a portion was obtained during the last fiscal year. Another collection of special note was obtained from Major H. N. Rust, of Pasadena, California. It comprises several types and numerous examples representing the stone artifacts of southern California. Advantage was taken also of the opportunity to acquire a number of the remarkably faithful Indian portraits executed by Mr J. H. Sharp, of Cincinnati. A particularly instructive collection of obsidian blades (including the largest known specimens) was also obtained during the year through Mr Nathan Joseph, of San Francisco, while a few particularly fine pieces of aboriginal Alaskan workmanship were obtained from Lieut. G. T. Emmons. A small collection of basketry produced by the renegade Apache at Palomas was picked up by Mr McGee, together with several pieces of Pima basketry made near Maricopa. A small but noteworthy object obtained was an authenticated Sitting Bull belt of beaded elk skin; and half a dozen small collections of stone implements and weapons were secured.

PROPERTY

The property of the Bureau is practically limited to (1) office furniture and apparatus, (2) ethnologic manuscripts and other original records, (3) photographs and drawings of Indian subjects, (4) a working library, (5) collections held temporarily by collaborators for use in research, and (6) undistributed residue of the editions of the Bureau publications. The fiscal year witnessed little change in the amount or value of the office property. The accumulation of manuscripts and other records of original work progressed steadily; about a thousand photographic negatives, together with several hundred prints and a number of drawings, were added to the collection of illustrative material. The library maintained normal growth chiefly through exchange, and the number of back reports was considerably reduced through the constantly increasing public demand for ethnologic literature. Mr J. Julius Lund continued in charge of the property as custodian.

NECROLOGY—FRANK FREDERICK HILDER

On January 21, 1901, the Bureau suffered a grievous loss in the death of Colonel F. F. Hilder, Ethnologic Translator.

Frank Frederick Hilder, soldier, geographer, and ethnologist, was born in Hastings, England, in 1836. Educated at Rugby in the approved manner of the times, he afterward graduated from the British military school at Sandhurst, and entered the army as a cornet in early manhood, at a time when the eyes of all England were turned on India. Sent immediately to aid in quelling the Sepoy rebellion, he soon saw service of such severity, and met it with such intrepidity, that he was awarded the Indian Mutiny medal, with special-service bars for Delhi and Lucknow.

It was during this period of his career that Hilder traversed the Indo-Gangetic plain, trod the Himalayan foothills, and visited the provinces and cities of the

northwestern empire from Bombay to Kashmir, and from the Punjab to Nepal, laying the foundation for a broad yet precise geographic and ethnologic education; and some of the lectures of even the latest years of his life drew inspiration and significant detail from the researches enlivening these early campaigns. He saw service also in Farther India, Borneo, and the Philippines, and after rising through a lieutenancy to the rank of captain was transferred to Africa. Here he won the Egyptian medal, and his skill as military expert and organizer attracted such attention that after his return to his regiment in India he was recalled and promoted to a colonelcy at the express request of the Khedive.

In Africa, as in India, Colonel Hilder seized every opportunity for scientific research; but his tenure in the Egyptian army was cut short by the terrible experience of a sand-storm, which so injured his eyesight that he decided to abandon a military career. Coming to America on his recovery, Colonel Hilder met again the contagion of military spirit stimulated by our civil war, and did special work of importance in the Engineer Corps, but held so firmly to his election of a peaceful life as to decline an American commission. In the later sixties he became the international representative of a small-arms manufactory, and spent fifteen years chiefly in travel through the several Spanish-American countries; and during this period he acquired an extended and intimate acquaintance with languages and peoples, as well as with national leaders and policies. Impressed by the opportunities for international business presented by the actual and prospective republics of Spanish America, he established a house in Chicago, only to be ruined by the fire of 1871; later he combined business enterprises in St Louis and Mississippi City with notable researches in the archeology of the Mississippi valley. Unhappily pursued by conflagrations, he turned to research and publication, making important contributions to the projectors of the Pan-American Railway and the Bureau of American Republics.

Colonel Hilder acted as secretary of the National Geographic Society during the year ending June, 1899, afterward becoming Ethnologic Translator in the Bureau of American Ethnology. He continued in this position to the time of his death, though he was detailed as a special agent of the Pan-American Exposition for work in the Philippines during the earlier half of 1900. Despite the briefness of his connection with the Bureau, he had already made himself a place among the most valued and trusted members of the corps.

As indicated by his career, Colonel Hilder possessed remarkably strong character; yet he was by instinct a naturalist and student, and devoted the best energies of his life to the increase and diffusion of knowledge. His later publications, through the Bureau of Education and the Bureau of American Republics, as well as through the National Geographic Magazine, the Forum, and other standard periodicals, are well known; while his graceful and instructive lectures, based on personal observations in India, Egypt, South Africa, Central America, the Philippines, and other remote regions, live in the memory of thousands.

FINANCIAL STATEMENT

Appropriation by Congress for the fiscal year ending June 30, 1901, "for continuing ethnological researches among the American Indians under the direction of the Smithsonian Institution, including salaries or compensation of all necessary employees and the purchase of necessary books and periodicals, fifty thousand dollars, of which sum not exceeding one thousand five hundred dollars may be used for rent of buildings" (sundry civil act, June 6, 1900)..... \$50,000.00

Salaries or compensation of employees.....	\$34,080.45
Special services.....	\$526.35
Traveling and field expenses.....	2,112.82
Ethnologic specimens	3,388.78
Manuscripts.....	2,011.00
Drawings and illustrations	407.95
Negatives.....	10.40
Books and periodicals for library.....	822.58
Office rental.....	1,500.00
Office furniture.....	683.33
Lighting.....	94.53

Stationery, supplies, etc	\$1,238.04	
Freight	257.93	
Postage, telegrams, etc.....	72.50	
Miscellaneous.....	108.65	
		\$13,234.86
Total disbursement.....		\$47,315.31
Balance July 1, 1902.....		2,684.69

ACCOMPANYING PAPERS

The three papers presented in connection with this Report mark a forward step in the systematic researches undertaken by the Bureau, and relate to fields already more or less fully occupied by the authors represented. The paper of Dr Fewkes, Two Summers' Work in Pueblo Ruins, is based on explorations made in the heart of the pueblo country during the years 1896 and 1897, and serves, in connection with his previous writings, to extend our knowledge of the local tribes back into the shadowy time that witnessed the gathering of the clans on the plateaus and in the canyons of the Colorado valley. The ruins described are located in the middle part of the valley of the Little Colorado and in the upper Gila valley, to the south. In the prosecution of these researches Dr Fewkes has made much progress in verifying traditions of the Hopis and in determining affinities and movements of the prehistoric communities; and, by utilizing his rich fund of accumulated knowledge, he has succeeded in contributing materially to our understanding of the unique culture of this remarkable region.

The paper by Dr Thomas, Maya Calendar Systems, deals with the interpretation of the ancient records of the Maya tribes of Middle America. Not having discovered an American Rosetta stone, the students of this important branch of native culture have given chief attention to the more pregnable features of the records—the systems of numeration as applied to the native calendar. Largely through the persistent and most praiseworthy efforts of A. P. Maudslay, the known examples of glyphs, sculptured in stone and wood, modeled in stucco, and painted

on walls, have been accurately recorded and published and are available to students the world over, and discussion can now proceed to much better advantage than heretofore. A first paper on the Maya calendar systems by Dr Thomas appeared in the Nineteenth Annual Report of the Bureau, and the present paper continues the discussion, with special reference to the interpretations of Mr Goodman. These papers necessarily assume a somewhat controversial character, but this is probably not to be regretted, since the legitimate outcome of honest controversy is a closer approximation of the truth. Already some notable results have been achieved and are generally accepted, and a fair understanding of the entire calendar system may be looked forward to with confidence.

"The Hako" is an important ceremony enacted by various western tribes, and the record presented in the paper by Miss Fletcher is exceptionally full and satisfactory. This record was made among the Pawnees under most favorable conditions. After years of patient work the words and music of all the songs and explanations of the rites and the hidden meanings of every word and act were obtained. This was done mainly through the aid of an old man of the Chaui band who is known as the Kurahus or leader of the ceremony. Like primitive ceremonies generally, this is a prayer, and its motives are peace, plenty, and abundance of offspring. It is intertribal, and not only serves as a means for the interchange of ideas through contact and through gifts but represents one of the many powerful agencies which, by spreading tolerance and friendly feeling, tend to weld scattered warlike bands of men into great peaceful nations. In its melodies, recorded on the graphophone and transcribed into our notation by a skilful musician; in its meters, carefully studied and analyzed; and in the metrical translation, which has caught so perfectly the spirit of the original, there is abundant material for students of music, poetry, and religion. The Bureau is fortunate in being the means of presenting to the world this superb study of a typical aboriginal ceremony.

ACCOMPANYING PAPERS

TWO SUMMERS' WORK IN PUEBLO RUINS

BY

JESSE WALTER FEWKES

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TWO SUMMERS' WORK IN PUEBLO RUINS

By JESSE WALTER FEWKES

SUMMER OF 1896

GENERAL OUTLINE

The following report embodies the results of archeological field work for the Bureau of American Ethnology in the summer of 1896.^a

The author was fortunate in having as his assistant Dr Walter Hough, of the National Museum, who, at his suggestion, took up in addition a study of Hopi ethnobotany, the results of which study have already been published.^b

A week after his departure from Washington on May 30 the author began excavations at a ruin called Homolobi, near Winslow, Arizona, where he worked continuously until the close of June. During July and a part of August he excavated ruins at the mouth of Cheylon fork, on the Little Colorado river, and at Chaves pass.^c

The short distance of Homolobi and the Cheylon ruin from Winslow allowed him to make daily trips from that town to the ruins, where the workmen were encamped. At the close of each day's work the objects found on that day were carried to the hotel, where they were catalogued and packed for shipment. Even with this precaution some of the specimens were appropriated by visitors attracted by the beauty of certain of the pottery objects. While archeological work in the vicinity of a town has advantages so far as the practical work of boxing and shipping are concerned, it has many disadvantages, one of the least of which is that just mentioned.

The considerable distance of the Chaves pass ruins from a town necessitated a camp at the diggings, which was far from a hardship, considering the beautiful forests and the fine water near the ruins. A camp was made at Old Shumopovi during a short stay at this ruin.

^a A preliminary report on the field work of this year may be found in the Annual Report of the Smithsonian Institution for 1896.

^b American Anthropologist, May, 1897.

^c This report was written and transmitted for publication in 1898. Since that time there has been considerable archeological activity in Arizona, and several collections have been made in the region, even in the ruins here considered. Certain specimens in these collections add important data to the discussion of the culture and migrations of the people who once inhabited this part of the Territory.

The objective material collected numbered 1,875 entries in the National Museum catalog, but since many of these entries include several objects, the actual number of specimens obtained was somewhat larger. The specimens were collected from the following localities:

Homolobi.....	700
Cheylon fork (Hopi name, Cakwabaiyaki)	635
Chaves pass (Hopi name, Tcübkwitcalobi)	284
Shumopovi	108
Various other ruins	97

^a 1,824

Other specimens were obtained from various ruins on the Little Colorado, and from Mishongnovi, Awatobi, Sikyatki, and Old Walpi.

By far the greatest number of specimens collected were objects of a mortuary nature from the cemeteries. Although many of these were broken in getting them out of the ground, it is estimated that over one-half were entire, and fully two-thirds of the remainder have been so well repaired that they answer all the purposes of the student. The breakage was in part due to the inexperience of the workmen, but most of the vases, bowls, and the like were fractured by the earth, logs, or stones thrown on them in the graves when they were buried. Each bowl appeared to have formerly contained mortuary offerings of some kind, as food, paints, or prayer-sticks, and it was not rare to find food bowls piled up in nests one within another. There is no conclusive evidence that any large number of vessels were broken by design when interred.

At the close of the archeological work on the ruins mentioned, the author witnessed the Flute ceremony at Mishongnovi, and the Snake dances at Oraibi, Shipaulovi, and Shumopovi. Some of his observations on the latter have been published in the Sixteenth Annual Report of the Bureau of American Ethnology, and a short description of the Mishongnovi Flute altars, observed in 1896, appeared in the Journal of American Folk-Lore. The author also made a few studies of the Walpi Flute observance, which supplemented those already published elsewhere, and enabled him to prepare an extended memoir on this important ceremonial as performed on the East mesa.^b

On his return to the railroad, after the close of the summer's work, the author visited Zuñi to prospect for ruins in anticipation of future exploration, and made a flying trip to the pueblos Isleta, Sandia, and Tesuki. A small collection of ethnological objects was made at these pueblos, and other specimens were purchased at Santa Fe; these, consisting of old paintings on skin from ancient pueblo missions, have been presented to the National Museum. It is believed that there is considerable material in the hands of traders or others in the Southwest, illustrative of the early mission period, which ought to find a

^a Besides the 1,824 specimens catalogued in the field 51 additional objects were entered in the National Museum catalog.

^b See Nineteenth Annual Report of the Bureau of American Ethnology, 1900, part 2, p. 952-1011.

permanent home in the National Museum. Some of these objects are very old, and show a mingling of Pueblo and Christian symbolism which is highly instructive, but in the rapid extinction of old manners and customs they are being replaced by more modern objects, and will soon disappear completely. Their preservation might well occupy the attention not only of the ethnologist but also of the historian.

Although the visit to Pueblo Sandia was a short one, of the nature of a reconnaissance, it was full of interest. For some unknown reason this pueblo seems to have been overlooked by most ethnological students of the pueblos, but to one interested in the Hopi Indians, Sandia presents many highly instructive problems. It is peopled by descendants of the people of Payüпки, now a ruin on the Middle mesa, and no doubt the Sandians have legends of the former home of their ancestors in Tusayan.^a

Sandia has a large kiva, not unlike those in other Rio Grande pueblos, where old rites are undoubtedly still perpetuated. It would be interesting to know something of the nature of these ceremonies, in order to compare them with those of the Tusayan ritual.

The author hoped that he would be able to find some ruins in the immediate neighborhood of Holbrook, Arizona, and he visited the mesa north of the town with that thought in mind; but he was disappointed, although evidences of temporary camps and a few pictographs were discovered. He heard, however, of ruins at Carrizo, and saw a few beautiful specimens of stone objects from that locality. The trip from Navajo Springs to Zuñi failed to reveal any considerable ruins along that trail, but the examination was a superficial one. There are several large ruins not far from the Navajo railroad station, which were not examined.^b

There are small ruins on some of the hills of the bad lands of the petrified forests^c near Holbrook. One or two of these are of considerable size, and many objects indicative of former visitants or occupants were found on the ground about them. The author succeeded in discovering a single grave in one of the mounds, and excavated from it a few fragments of pottery, but these objects did not occur in sufficient quantities to justify extended work. Not far from Adamana station, on the Atlantic and Pacific railroad, there is a large ruin on a hill, which visitors to the petrified forest have no doubt noticed. This ruin is of considerable size, and promises a rich yield of archeological material should reasonable excavations be made outside its walls.

^aOn a map by Menchero the site of Payüпки is called "Mesa de las Tiguas," indicating that it was peopled by Tiwas. Some of the Hopis say that relatives of the Asa clan once lived there.

^bSome of these ruins were specially studied in the summer of 1897, and will be described later in an account of the operations of that year.

^cThis remarkable collection of fossil trees is about 15 miles from Holbrook, and may be called one of the wonders of Arizona. There are in reality three petrified forests, or three places where the bad lands are eroded sufficiently to lay bare the huge fossil trees which they cover. The signs of former habitation observed in the section nearest Holbrook show comparatively late occupation.

RUINS ON THE LITTLE COLORADO RIVER

GENERAL FEATURES

The plains and mesas bordering the Little Colorado river and its tributaries were sites of populous pueblos in prehistoric times. There remain many descendants of this former population who now inhabit pueblos distant from that stream. The Zuñis alone still live on the bank of one of its tributaries, and from the source of the river to its mouth the ancient pueblos have long since been deserted. It is asserted by certain Tusayan clans that their ancestors formerly inhabited the pueblos now in ruins on this river, and traditionists have names for these villages. The plan of the present expedition was to explore ancient ruins claimed by the traditionists of the Patki, Patuñ, and Piba people as a former home of their families, in order to determine the truth of their legends and to gather what archaeological data there were bearing on the prehistoric migrations of the people who inhabited the western section of the pueblo area.

The ruins along the Little Colorado do not differ greatly in general character from those in the vicinity of the inhabited Hopi pueblos. They are situated both in the river valley and on bordering mesas, and, owing to the open character of the country, are mostly of the village type. Some of the tributaries of the Little Colorado in the Mogollon mountains are said to be overlooked by cliff houses, several of which, in Clear creek canyon, still remain well preserved, according to report; but these ruins have not been investigated.

Drifting sand has buried most of the ruins of the valley so deeply that the walls of few of them remain standing above ground. As a rule they are built on natural mounds, which, near Cheylon fork, have a gravelly character.

There is little to guide one in a determination of the probable age of the ruins. No evidences of Spanish influence were detected in the excavations, but this does not, of course, necessarily mean that the pueblos were not inhabited contemporaneously with, or long after, the advent of the Spaniards.

It is instructive to determine the probable causes of the evacuation of these river villages by ancestral Hopi clans. Among other influences, the following may be mentioned. In the legends concerning the forays of the Apaches it is always recounted that they attacked the Hopi pueblos from the south. Although these vigorous nomadic people originally came from the north, they seem to have early taken possession of the portion of Arizona between modern Tusayan and the southern boundaries of the Territory, raiding as they wished the Pima settlements on the south, and the Hopi on the north. The exposed pueblos along the Little Colorado were poorly adapted for defense, and this may have led to their abandonment.

Some years ago two Mormon towns were built not far from the present site of Winslow, and contiguous to Homolobi. These towns, Brigham and Sunset, were prosperous for many years, and their inhabitants cultivated extensive farms, which were irrigated from tributaries of the Little Colorado. The remains of one of their acequias can still be seen skirting the river side of Homolobi, and many of the stones for the walls of the towns are said to have been obtained from the Indian pueblo. The Mormon town is itself now a picturesque ruin, having

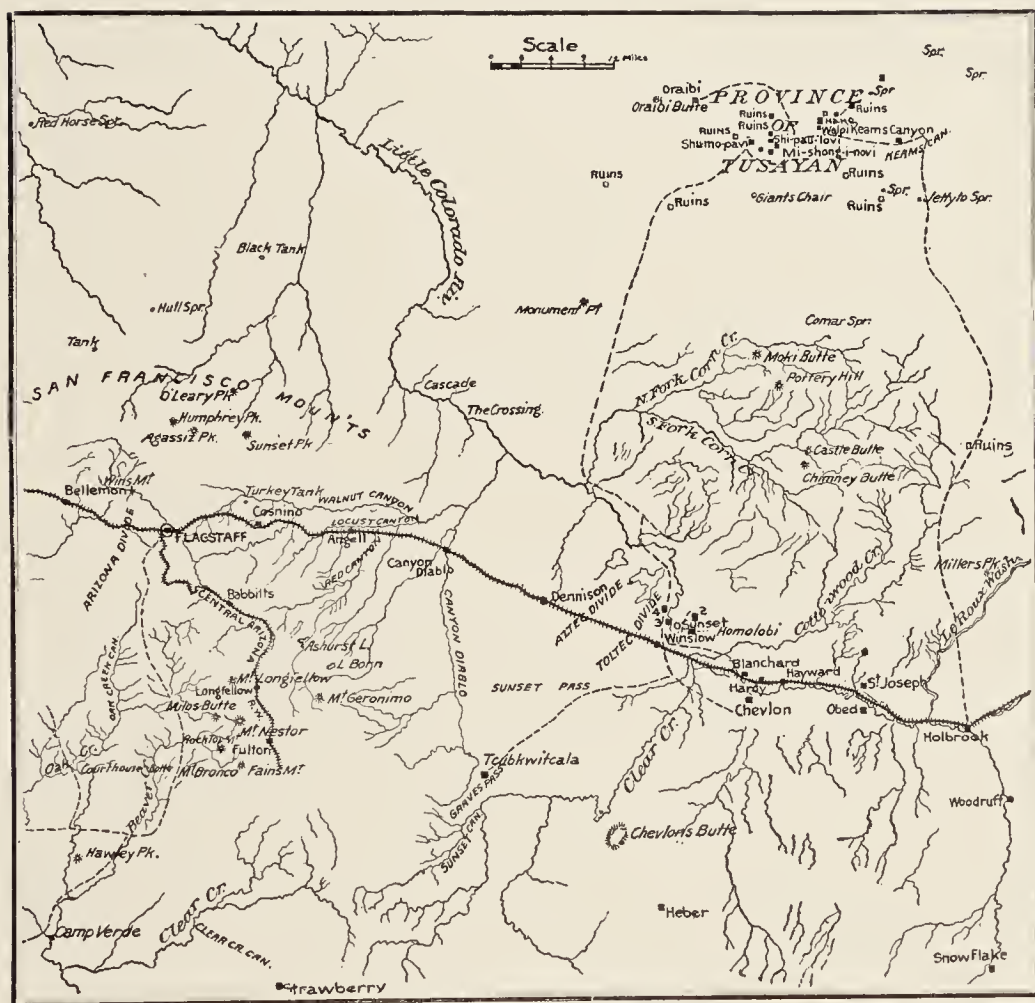


FIG. 1. Map of Ancient Tusayan.
(Itinerary indicated by dotted lines.)

been gradually abandoned. One reason for the desertion of Sunset is said to have been the alkalinity of the soil, which irrigation had developed. If this explanation accounts for the failure of the Mormon farmers, it might also apply to their Hopi predecessors. The failure of crops may have led the Indians to seek other localities better suited for farming. However that may be, at the present time, 1896, the river valley opposite Homolobi has been turned into a profitable farm by a Winslow farmer, and when the author worked at

Homolobi this farm was green with alfalfa and various market vegetables.

A failure of the rain and the corn crop is distinctly mentioned as one of the causes which led the Patki and other southern Hopi clans to leave their settlements along the Little Colorado, but it is also stated that they were afflicted by a kind of gnat or sand flea in some of their earlier halting places. Possibly their dwellings became so infected with vermin as to lead to their abandonment.^a

The Little Colorado river was dry during the work at Homolobi, and was crossed and recrossed almost anywhere, the sole obstruction being the steep banks, which were several feet high. Late in the summer, however, it became a raging torrent, impassable save in one or two places, and even these were dangerous on account of the many quicksands. It is not improbable that the great freshets of the river may have had an important influence in the abandonment of the second ruin of the Homolobi group, one side of which is completely worn away, although of course it is not unlikely that this happened after its abandonment. Evidence of similar erosion is also apparent on the river side of ruin 1 of the Homolobi group; cemeteries on that side, if they ever existed, have long since disappeared.

RUINS NEAR WINSLOW

As has been noted, the Hopis say that the ancestors of the Patki or Water-house^b people lived in the far south. This tradition is very definite, and it even declares that they once inhabited a pueblo called Homolobi, stating that the position of this ancestral dwelling was near where the railroad crosses the Little Colorado, not far from the town called Winslow. With this exact statement as a guide the author went immediately to that town, having made arrangements with some Hopi workmen to join him there.

The ruins on the Little Colorado near Winslow were identified as the Homolobi group by Mr Cosmos Mindeleff, who mentions 10 ruined pueblos in this immediate vicinity, but his reference to them is brief, and includes no attempt at description. The best-informed inhabitants of Winslow were ignorant of the existence of ruins near their village, and but for the confidence he had in the legends of the Hopis the author also would have doubted their existence.

The site of Homolobi was found to be exactly where the Hopi stories placed it, and archeological results confirmed the identification. The author found not only Homolobi, but also three other ruins in the immediate neighborhood of Winslow, and before a month had passed demon-

^aThe trail from Beaver Head in the Verde valley to Flagstaff, especially not far from Rattlesnake Tanks, has a very bad reputation for the small gnat, which gives much annoyance to travelers.

^bThe name Water-house means cloud, and the members of this clan are called both the rain and the cloud people.

strated that this was one of the richest fields in Arizona for archeological work, although previous to this visit not a single specimen had been described from the region.

It was also the author's desire to see how the ruins of the Little Colorado south of Tusayan were connected with those on the banks of its tributary, the Zuñi river, higher up the watershed. For that purpose he examined somewhat in detail a ruin opposite the station Hardy, on the Atlantic and Pacific railroad, near where Cheylon creek empties into the Little Colorado river. This ruin will be called in this report the Cheylon ruin. Its Hopi name is Cakwabaiyaki.

The objects exhumed from the cemeteries of the Cheylon ruin have close likenesses to those of ancient Zuñi ruins, as well as to those of Homolobi, which is claimed by the Hopis. A logical interpretation of these resemblances would seem to be that the culture differentiation of the two peoples was not as wide in ancient times as it is at present. The inhabitants of the villages of the Little Colorado and its tributary, the Zuñi river, were formerly closely related, and, no doubt, when these villages were deserted, some of the clans went to Zuñi and others to the Hopi pueblos. In subsequent times greater differentiation took place, which led to the present conditions.

It was also desirable to push the examination of the ruins of this drainage area as far south as possible, for which reason two ruins in Chaves pass, about 30 miles south of Winslow, were investigated. This was the southern limit of field work in 1896, and in the last month of the summer the author followed the trail north to connect the Homolobi ruins with those of the Hopi reservation.

We have good evidences from historical and legendary sources that there were inhabited pueblos between Zuñi and Awatobi as late as the middle of the seventeenth century. One of these, that of the Cipias (Teipiya, according to the Hopis), is distinctly mentioned as west and south of Zuñi. It is not probable that all clans of the Patki people had wholly deserted Homolobi in the sixteenth century, and they may have been dwelling there as late as 1700. It is as yet an unanswered question whether any one of the ruins which were excavated in 1896 is Teipiya, which, according to the Hopis, the Zuñis declare was midway between Awatobi and Zuñi.

THE HOMOLOBI GROUP

LOCATION

There are four ruins near Winslow, which may be called the Homolobi group and are provisionally numbered 1, 2, 3, and 4. Of these, ruin 1, true Homolobi, yielded the best archeological results, and was nearest to the town, being about 3 miles away. More excavations were attempted at that place than at all the others. The ruin numbered 2 is about three miles farther down the river and more distant

from it, but is on the same side. Ruin 3 lies on the left bank of the river, about midway between the first and second, and ruin 4 is a few miles beyond on the same side, somewhat removed from the river. All of these ruins are thus within a radius of 6 miles of the town of Winslow.

FORMER INHABITANTS

Several Hopi clans, belonging to groups called the Water-house, the Squash, and the Rabbit, are said to have lived in these settlements along the Little Colorado, near Winslow. Among the clans of the first-named group may be mentioned the Corn, Agave, Rain-cloud, Lightning, and various others whose totems are aquatic animals. A list of them follows:

Patki	Water-house
Kaü	Corn
Omanwü	Rain-cloud
Tañaka	Rainbow
Talawipiki	Lightning
Kwan	Agave
Sivwapi	Bigelovia graveolens
Pawik	Aquatic animals (Duck)
Pakwa	Frog
Pavatiya	Small aquatic animals, Tadpole (pakwa, frog; tiyo, young)

The prominent chiefs of Walpi who belong to the Patki or Water-house people are Supela, Kwateakwa, Sikwistiwa, and Kwaa. Anawita of Sichumovi is also a member of the family. The legends of Homolobi were told to the author by the last mentioned, but Supela and the others have much lore concerning this group of ruins which has never been published.

The Patuñ or Squash people, now extinct on the East mesa, are also said to have lived at Homolobi, and they are reputed to have settled at Teukubi on the Middle mesa, and the Tawa or Sun people, who are associated with the Pakab or Reed clans, once lived with the Rain-cloud and Squash people in the Homolobi settlements.

There is evidence from the present Hopi ritual that the Patki, Patuñ, Tawa, and Piba (Rabbit) families, among others, lived at Homolobi. For instance, it is stated that the following clans introduced the societies and ceremonies mentioned, with their fetishes, into the modern system:

Clans	Ceremonies	Societies
Patki	{Soyaluña --} {Palūlūkoñti}	{Kwakwantū {Lalakoñtū
Piba	New-fire	Tataukyamū
Patuñ	New-fire	Wūwūteimtū

This statement is supported by the facts that the chief of the Kwakwantū, the great warrior society,^a is Anawita, and that Supela is one

^aKwahu, eagle; kwan, agave.

of the chiefs in Soyaluña. The Sim priest, Kwateakwa, takes a prominent part in the screen drama of Palülüköñti. The Kwakwantû, Eagle-agave people, are distinctly southern, coming from the region in Arizona where the great cactus or agave grows, and an examination of details of the ceremonies mentioned shows an instructive likeness to Mexican rituals. In both Soyaluña^a and Palülüköñti the effigies of the Plumed Snake play important parts, and this conception is distinctly a Mexican one, recalling Quetzaleoatl. It is for those ceremonials in which there is the closest likeness to Nahuatl rites that southern origin is claimed by the chiefs and other participators.

RUIN 1

As has been stated, the nearest of the Homolobi ruins to Winslow—the one which was chosen for extensive excavations—is about 3 miles distant on the right bank of the river, and about the same distance from where the river is bridged by the Atlantic and Pacific Railroad. At that point there are several small knolls separated by level spaces which might once have been cultivated fields. Between the site of the ruin and the river bank there is a small grove of cottonwood trees, the bases of which are evidently at times flooded by the overflow of the stream.

The river takes a general northwest course from the railroad crossing, and is bordered with cottonwoods. On either side the banks are low and sandy, frequently eaving in, rendering it treacherous to approach at certain seasons of the year.

The neighboring plains are parched and dry in the spring and early summer, and violent sandstorms sweep over them, oftentimes so dense as to obscure all outlook. At these times work along archeological lines is very disagreeable, and life in the village is far from pleasant.

When approached from Winslow the ruin is indicated by a number of low mounds without standing walls, and when it was first visited there was little to indicate that it was the site of a former pueblo, save many fragments of pottery strewn over the surface. The indications that Homolobi would be a profitable field for archeological investigation were very small.

The excavation of ruin 1 of the Homolobi group began about the first day of June, when a force of 5 Mexicans was employed to open the mounds at the northeast angle. The results of the work were not very satisfactory. They betrayed the fact that Homolobi was a pueblo of small size and of irregularly rectangular shape, with its highest walls on the northeast side. Considerable broken pottery, some stone implements, and other objects were obtained, but all the evidences appeared to indicate that the more valuable specimens were removed when the pueblo was abandoned.

^aAn illustrated account of this winter solstice ceremony may be found in the *American Anthropologist*, v. 11, March and April, 1898.

The workmen penetrated to the lower floor, and found that the pueblo was two stories high at this point. The rooms were large and the beams of the flooring were well preserved. The floors of the rooms were large, flat stones; the lower chambers were nicely paved. The walls were made of stone masonry, nicely plastered, and in some instances blackened by smoke. In one of the largest of these rooms the floor stones were in two cases found to be perforated by round holes about the size of a sipapû in modern kivas. These slabs are in many respects similar to those found in graves outside the walls of the pueblo.

Two human skulls, one of which indicated an old person, and several human bones were found on the floor of chambers in the northeast part of the ruin, and were supposed to represent intramural

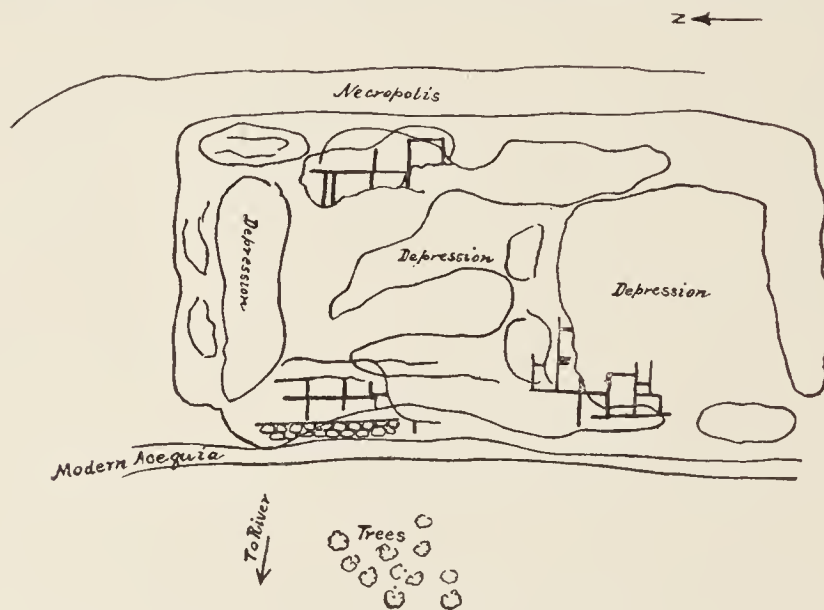


FIG. 2. Ruin 1, Homolobi.

burials. No pottery, however, was found in the vicinity of these skeletons, which fact would seem to indicate that they were not buried with customary mortuary offerings.

Continued work on the side of the ruin toward the river revealed the fact that this part had been worn away by the overflow of the stream, and a section had been cut through it in digging an irrigating ditch which formerly supplied the plains around Sunset with water.

The osteological collection from Homolobi was very large. Early in his excavations the author was surprised at the number of animal bones which were thrown out by the workmen, especially after they had penetrated to some distance below the surface. There appears no better explanation for the existence of these bones than that they were remains of animals domesticated or used as food. These bones were carefully gathered, and have been identified by Mr F. A. Lucas, of the National Museum; a complete list of species found at Homolobi is published in this report, page 110.

The occurrence of a skull of the domesticated dog in one of the graves at the Chaves pass ruin is significant, showing that this animal was known to the ancients, and probably utilized by them. The fact that this dog was the broad-faced variety is particularly instructive. It was not apparently a domesticated coyote or a mongrel like those which now are so common in some of the pueblos. Mr Lucas has published the following account^a of this specimen:

Among the many objects obtained by Dr Fewkes last summer from the ruined pueblo of Chaves pass, Arizona, is the cranium of a domesticated dog found in a grave with a human skeleton. Although the mere fact of a dog being discovered under such circumstances is in itself interesting, it is not at first sight remarkable, since it is well known that in America, as elsewhere, the dog was domesticated at an early date, and Clavijero mentions an ancient dog, which he calls "a quadruped of the country of Cibola, similar in form to a mastiff, which the Indians employ to carry burdens." Aside from the fact that this is the first dog's cranium discovered by Dr Fewkes, there are some points of special interest in the present case. Most of the Indian dogs are more or less wolfish in their aspect and have long skulls, with comparatively low foreheads, thus showing a small degree of specialization in the way of breed, and this is true of such of the mummied dogs of Egypt as I have seen. The cranium of the Chaves dog, on the contrary, is of the broad-faced type, with high forehead, and, curiously enough, is precisely similar in size and proportions to the cranium of an Eskimo dog from Cumberland sound, the resemblance extending to the peculiar concavity and squareness of the nasal region. While this is an interesting coincidence, it is not brought forward as implying community of origin, but as instancing long domestication in order that so well-marked a breed could be established. A curious confirmation of the early origin of this breed was received from San Marcos, Texas, where, in excavating for ponds at the station of the United States Fish Commission, a human skeleton and bones of other animals were found in a layer containing many flint implements, overlaid by two feet of black soil. The bones were those of existing species, including teeth of several bison, and there was also a fragment of a dog's skull similar in size and proportions to that obtained at Chaves pass. Owing to the circumstances under which the bones were exhumed, it is not known whether or not the dog and man were found together. While none of the bones were mineralized, the condition under which they were found and the character of the human cranium showed them to be of very considerable age.

Dr Fewkes states that the skulls of carnivores are used in Hopi religious ceremonies, and that the skull, paws, etc., are regarded as powerful fetishes of warriors and cherished by them with much care. It is customary to bury a priest's fetishes with him, and there is little doubt that the dog's cranium from Chaves pass was a fetish of the man in whose grave it was found. As Dr Fewkes believes that the people of the Chaves pass ruin formerly lived far south, in contact with Nahuatl peoples, it can readily be seen how a dog's skull came to be part of the ceremonial outfit of the priest in whose grave it was found.

The numerous turkey bones which were found do not necessarily mean that this bird was used as food by the ancient sedentary peoples of Arizona. We are told by the historian of Coronado's expedition that the Pueblos had domesticated fowls, but these were probably turkeys from which, as at present, were obtained feathers used in

^a Science, n. s., v. 5, 1897, p. 544.

ceremonial practices. It would hardly seem possible that birds whose feathers were thus used would be eaten, although parallels to such a usage occur in the religious rites of many peoples. We know that their bones were made into needles and bodkins, and there is every probability that the wild turkey's flesh was eaten.^a

Because of the poor results of the early excavations at Homolobi the author determined to abandon the work at this ruin. A search for the burial places was not successful, although he carefully examined the sandy hillocks a few hundred feet away, expecting that they would be found there if anywhere. Meanwhile a half dozen Hopi Indians who had been sent for came to Winslow, and the author set them at work, having discharged the Mexicans. On the first day they discovered the cemeteries of Homolobi, after which it was only a question of time before a large collection was obtained.^b

The burial places at Homolobi were close to the outer wall of the pueblo, so near to it in fact that the skeletons in some instances touched the outer face of the wall. These places of burial were literally "under the ladders" of the town, if we believe, as we legitimately may, that the inhabitants formerly mounted to the house tops by ladders.

The outer slope of the mound was thus found to be crowded with the dead, and with them were multitudes of mortuary pottery offerings of all kinds. These cemeteries were found on the east^c side, opposite the river bank, and although it is possible that in ancient times burials may have been made on the side of the mound toward the river, if they ever were there the overflow of the stream has washed them away or covered them up.

The burial places were sometimes recognized by flat stones set on edge projecting above the surface of the soil. These stones had often fallen in over the grave, and were sometimes buried many feet below the surface. In many of these there was a small, round hole about the size of a broom handle; in others this hole was large and square. In one or two instances traces of pigment were detected on these burial stones, but in the majority the figures were not legible. The reason assigned by some of the Hopi workmen for these perforations was for the escape of the soul; others regarded them as symbols of the sipapû, openings in the kiva floors which they closely resemble. In the pavement of one of the larger rooms which was excavated two slabs were found, one of which was perforated with a single

^aThe eagles which are kept in the Moki towns to-day for the feathers used in ceremonies are buried at death in certain cemeteries with ceremonies of a simple character.

^bIn the winter of 1897 Dr G. A. Dorsey, of the Field Columbian Museum, made some archeological studies of Homolobi, and he informs the author that he found many interments with beautiful mortuary pottery not far from the trenches made in 1896. Others have dug many specimens from the same ruin.

^cWhile as a general thing the cemeteries to the east of a ruin are the largest, places of burial are not confined to that side of a ruin.

hole, and the other, which was broken, had a hole in the middle and a round notch on the broken edge, as though there had once been a perforation at that place.

RUIN 2

Ruin 2^a of the Homolobi group, unlike ruin 1, is situated on top of a hill with a wide outlook. This is a much larger ruin than 1, and the walls standing above ground are in a better state of preservation. No very extensive excavations were undertaken in this ruin, but a few graves were found some distance from the walls near the foot of the hill on which the pueblo was built. Several graves were indicated by upright slabs of stone set on edge in the soil, and from them a dozen or more mortuary vessels were excavated. The pottery was like that of ruin 1 in general character, yellow and brown ware predominating.

From the great size of this ruin the author suspects that if it were carefully excavated a rich collection might be found, but work upon it would be difficult, as it is situated quite a distance from water, and there are other practical difficulties, some of which, however, might be easily overcome.

A number of bowls were found on the sides of the mesa on which this ruin stands, but these appear to indicate isolated burials; the cemetery was not discovered, and consequently the number of mortuary objects from the ruin was small.

RUIN 3

Ruin 3 of the Homolobi group is very small, and is situated so near the present bed of the river that a portion of it has been worn away by the water.

One of the most interesting features of this ruin is the use of blocks of adobe instead of stone in some of the partitions of the rooms. The situation of this ancient dwelling was such that stone was not easily obtained, and consequently, as so often happens elsewhere in the Southwest, adobe was utilized as a building material.

Farther down the Little Colorado the author found in the ruins on the plains which border the river indications that the ancient houses were made of adobe alone, a fact readily explained by the absence of suitable stone on the site of the habitations.

No other ancient Tusayan pueblo where adobe was used for the construction of houses is known, and for the most part to-day the building material is rock from the formation most convenient to the pueblo.^b

^aThis ruin, like ruin 1, was called Homolobi, and it is probable that the name is applied at the present time to the whole cluster of ruins near Winslow. As different phratries are reputed to have lived in this neighborhood, it may be possible to connect the several ruins with individual families.

^bThere are adobe walls built out from the old mission at Awatobi.

Very little in the line of exploration of ruin 3 was attempted, as only a single visit was made to it. The pottery fragments were identical in character with those from the other Homolobi ruins, and the size of the mound shows that it was a small settlement. The stream has encroached on the foundations of the ancient town to such an extent that the cemeteries on this side have been obliterated. The surrounding plain was evidently cultivated, for remnants of old ditches can be seen in the neighborhood, though they were difficult to trace on account of frequent changes in the neighboring stream.

One of the most interesting and exceptional objects taken from this ruin was a bone implement apparently made from the leg bone of an antelope. The blunt end of this object was carved in imitation of an animal, possibly a bear, the head, body, and legs being well represented.

RUIN 4

Ruin 4 of the Homolobi group is one of the most picturesque in this region, and has many resemblances to Shipaulovi, on the Middle mesa of Tusayan. It resembles a castle perched on the pinnacle of a butte, which is steep on all sides. Its height is possibly 100 feet from the plain, and it has a wide outlook across the valley of the Little Colorado. The top of the mesa is small and appears to have been covered with house walls built of stone, fragments of which have fallen down the steep sides of the mesa.

The general ground plan is roughly rectangular, apparently with a central court, and the indications are that the houses were not more than one or two stories high.

The débris at the base of the cliffs is full of fragments of pottery resembling that of ruin 1, and here undoubtedly we must look for the cemeteries, as there is no sign of a burial place on the top of the mesa. Near the foot of the mesa, and half way up its sides, bordering the rough trail by which one can now ascend to the former site of the pueblo, there are many large boulders, most of which are covered with pictographs pecked in the surface of the rock. These pictographs closely resemble those found almost universally in the western section of the pueblo area, and bear every evidence of being very ancient. Many of them were almost illegible, possibly from age, while others were fresh, suggesting more recent work. There are no painted pictographs, suggestive of the Apaches or other Indian tribes.

No excavations were attempted at ruin 4, and the author's visit there was a short one. Although the ruin is not quite as large as ruin 1, the abundance of pottery fragments gave promise that it would be a fruitful field for archeological studies.

THE CHEVLON RUIN (CAKWABAIYAKI)

Chevron creek is a small stream of water which empties into the Little Colorado from its left bank about opposite the station called Hardy, on the Atlantic and Pacific railroad. It is possibly 15 miles

east of Winslow, with which it communicates by a tolerably good wagon road. About 2 miles south of Hardy, near the Esperanza ranch, the creek makes a graceful curve, west of which there rises a low mound—the site of Cakwabaiyaki or Blue Running Water pueblo.

The country at this point is barren and sandy, with gravelly hills, and with rock jutting above its surface. There are no trees and only a few scrubby bushes of characteristic Arizona vegetation. The banks of Cheylon creek at this point are low, and in places there are numerous sand dunes. There is always water in the bed of the stream, but in the dry season much of it is lost when it gets to the thirsty sands of the Little Colorado valley. It is not potable, however, and animals do not drink it eagerly. Fishes and turtles in considerable numbers inhabit this stream.

The road from Winslow to the Cheylon ruin crosses the railroad in the suburbs of the town, following the plain to Salt slough, a putrid water hole, by whose alkaline waters many animals have been poisoned. From there the road leads to Clear creek, a beautiful stream which has been dammed to supply water for the town. A fine bridge has been built over Clear creek, and the water at that point is very deep. The banks are high and canyon-like, and the spot is one of the most picturesque near Winslow. From this stream our Indian workmen obtained many turtles, which they highly prize, and they make frequent pilgrimages to it from Walpi to get water to use in their ceremonies. Not far from the Clear creek bridge there are evidences of a former population, and the broken-down walls of houses crown some of the adjacent hillocks. There are likewise many ancient pictographs in this vicinity. Higher up Clear creek valley, where it is dry and is called Clear creek canyon—a place visited on the way to Sunset pass—there are many evidences of former human occupation and abundant pictographs, some of which are of considerable interest.

There are likewise said to be mounds similar to those at Homolobi on the banks of both Cheylon and Clear creeks, and there is little doubt that this is true—at all events as regards the former stream. Portions of canyons along the upper course of Clear creek were examined and numerous pictographs were found on their walls. There were also evidences of former habitations.

It must have been not far from Cheylon ruin where Sitgreaves and his party camped on October 2, 1851, but in his narrative he does not mention the ruin, though the short notice of camp number 9 corresponds with the locality in other respects. He says (page 7):

The river [Little Colorado] here receives a tributary known among trappers as Cheylon's fork, from one of that name who died upon its banks from eating some poisonous root. Their confluence produces an intricate labyrinth of sloughs, in which we became involved and were forced to encamp, not finding an outlet until late in the day. In several places veins of fibrous gypsum (selenite) were seen, looking like the ice crystals that burst open the ground in spring.^a

^a Report of an expedition down the Zuñi and Colorado rivers. Senate Document 59, Thirty-second Congress, second session, 1853.

This description may well apply to the mouth of the Cheylon in the month of August, when heavy rains are common, but in June the Little Colorado was repeatedly crossed near this point with the greatest ease, there being only a small rivulet to ford. Later, however, the river became a raging torrent, as the author found in attempting to ford it on the trip to the Tusayan villages in July.

The burials at Cheylon resemble those at Homolobi, and are similarly situated with relation to the ruin. Like those of the first ruin of Homolobi, interments were found in the largest number just outside the outer walls of the pueblo, and at different depths. The configuration of the site of the ruin naturally introduced some modifications in the character of the burials. The drifting sand has buried them somewhat deeper at Cheylon than at Homolobi.

No evidence of the cremation of the dead was discovered in the Cheylon ruin, at Homolobi, or in the ruins at Chaves pass. The dead in these three ruins were as a rule extended at full length, and not, as at Awatobi, placed in a sitting position.

THE CHAVES PASS RUIN (TCÜBKWITCALOBI)

Looking southward from Winslow one can see in the distance a high range of mountains which separates the valley of the Little Colorado river from that of the tributaries of the Salt and the Gila. This range is broken at one point by a pass through which, in old times, there was a trail used by Indians in trading excursions and migrations. It is called Chaves pass, from an old Arizonan named Chaves who was killed by Apaches near by. A small wooden cross in the open plain at the entrance of the pass is said to mark his burial place, and there are many other unmarked graves of white men who have lost their lives in this neighborhood.

By taking the road south from Winslow one passes over a hilly country continually rising, with Cheylon butte far to the left, and, skirting Clear creek, follows it to Sunset pass, which is clearly visible from Winslow. Beyond Sunset pass, where dwarf cedars afford a refreshing change from the treeless wastes about Winslow, the road, still rising, enters a well-wooded country between Sunset and Chaves passes. The road now becomes rougher, rising rapidly, with tall pines on all sides, until it passes an old well near the remains of a deserted cabin. This well is situated in Chaves pass, and there the road divides, one division continuing to Mormon lake and Rattlesnake tanks, where there is said to be a ruin of considerable size, and ultimately to the Verde valley, the ruins in which are numerous and extensive, the other to the Tonto basin.

Two ruins lie on the hills above the pass; one, the smaller, is the first approached on the right-hand side; the other is so placed as to force the traveler out of his way, the road winding about it. Both

are elevated above the trail through the pass, and from their house tops the observer can look across the valley, in which flows the Little Colorado, to the Hopi buttes, far to the north.

Their name, Teübkwitealobi, is derived from teübio, antelope, kwiteala, notch, and obi, locative. The Navaho name Jettipehika has the same meaning. Both names were due to the fact that the pueblo lay in mountains where no short time ago antelope were abundant.

During his stay in Winslow the author heard much about the ruins in Chaves pass and often gazed at the distant southern mountains, which particularly interested him as the possible gateway to Palatkwabi, the Red land of the South. Chaves pass was fascinating in its archeological possibilities, for it was one of the few breaks in the rugged Mogollones through which ancient migrations could have been made. Accordingly, after examining the ruin at the mouth of Chevelon fork, the author outfitted for a reconnoissance of the ruins which he expected to find in the pass.

It need hardly be said that this was virgin ground for archeological work. No one, so far as is known, has ever mentioned these aboriginal habitations, which is not strange, considering the great number of undescribed ruins in this part of Arizona. Ruins at this point were especially interesting from the fact of their elevation and their position almost on the crest of the watershed of two great valleys, the Little Colorado and Gila, both of which were sites of large populations in prehistoric times. It is highly important to discover whether they furnish a connecting link between the two regions. There can be little doubt that the trail through the pass is an old one, and that it was used in the migrations of Indians.

The two ruins at Chaves pass were built of the lava rock so abundant in this region. The larger must have been a pueblo of considerable size, and covers an area much larger than any of the Homolobi group except ruin 2. The elevation on which it is built is considerably longer than wide, sloping abruptly, but is easy of access on all sides. The ruin is apparently of the rectangular type, with inclosed courts. It is composed of two house clusters connected by a range of rooms one and two series deep. Its rooms are square, and their outlines can be readily traced, though they are much obscured by fallen walls. In general type there is a close resemblance between the Chaves pass and Verde valley ruins.

Some attention was given to excavations in the rooms of both of the ruins, but the limited work there was not rewarded with great success. The walls of the rooms were built of blocks of lava rock, which had tumbled into the inclosures, and it was necessary to remove these before the floors were reached. Very little sand had drifted into the rooms on account of their elevated site, and the outlines of the rooms and the contours of the walls could be readily traced. No

rooms could be identified as kivas, and the plastering was, as a rule, worn from the standing walls.

The burials at Chaves pass differ considerably from those at Homolobi and Cheylon. It was found that flat stones with perforations were not used in covering the burial cysts, but that logs—accessible in this wooded region—were employed. The bodies of the dead were extended at full length, and stones were laid at the head and feet. Upon these stones a number of logs were placed parallel with the bodies, and on either end of these logs there were other stones, generally boulders, to hold them down. The body was thus covered with a rude floor, over which soil is now found.

The depth of burial varied considerably, and it was not rare to find bodies 10 feet below the surface. The weight of soil above the logs had been so great, however, that they were pressed down upon the mortuary bowls, and many of these fragile objects were thus broken into fragments.

Thirty-one skulls in good preservation were taken from the cemeteries at Chaves pass. These are numbered in the National Museum catalog from 157669 to 157699, inclusive; but a large number of skulls and skeletons were abandoned, as they were in too poor a state of preservation for craniometric study. The facial bones of several crania from Chaves pass were stained green with carbonate of copper, and there were traces of black pigment on others.

The situation of the ruins at Chaves pass, which are, as has been stated, practically on the trail from the Little Colorado valley to the Verde, naturally leads to a comparison of the pottery objects from the two localities. Fortunately, a considerable collection of Verde valley pottery made by Dr Palmer is now in the Smithsonian Institution, and affords abundant material for a comparative study. There is so marked a similarity between the ancient pottery from Chaves pass and that from the Verde ruins, which in turn is related to that of the Gila-Salado basin, that it almost amounts to identity. It would be impossible from the character and color, as well as from the decoration of the mortuary ware from these two regions, to distinguish them. The same red ware with rude geometric decorations exists in both valleys. There is no doubt that the ancient people of the Verde valley were closely related to the builders of Casa Grande and the ancient dwellings near Tempe.^a

RUINS BETWEEN WINSLOW AND THE HOPI PUEBLOS

Under this heading are included the remains of habitations on the banks of the Little Colorado and its tributaries which were visited on trips from Winslow to Tusayan. The author followed the river for many miles in order to avoid the Moqui butte, and while he did not

^aThe ruins in the upper Gila valley, called Pueblo Viejo, were found in explorations in 1897 to be of the same character as those of Chaves pass and Verde valley.

go as far down as Voltz crossing, he forded the river only a few miles above that place.

The hills bounding the valley retreat a considerable distance from the banks of the river in that section of its course, and the road winds through a level plain destitute of rocks suitable for building purposes. At certain points, however, the author passed low mounds, not accurately mapped, upon which were scattered fragments of pottery, most of which was of rough manufacture. These mounds may have been sites of small adobe buildings which have weathered away, leaving only piles of soil. He attempted no excavations and found no standing walls of adobe or stone, but the presence of fragments of pottery in quantity would seem to indicate former habitation.

It would be instructive to dig into one of these mounds, which are undoubtedly artificial in character, in order definitely to determine their character, which it must be confessed is now highly problematic.

Although the cavate ruins near Flagstaff and the ruins near the Black falls were not carefully examined until 1900, they are described here for comparative purposes.

CAVATE RUINS NEAR FLAGSTAFF

The following account of these ruins and of those near Black falls was published in the *American Anthropologist* in 1900 (volume 2, page 423):

Sitgreaves, in 1852, seems to have been the first writer to refer to the ruins about Flagstaff and along the Little Colorado. He figures one of the ruined pueblos near the cascades or falls,^a a ruin of the same general character as those near Black falls, which he probably did not visit. Major Powell, in 1885, visited and later described^b the cliff houses, the cavate rooms of the volcanic cones, and several pueblo ruins north and northeast of Flagstaff. He did not visit the Black falls ruins, which are undoubtedly similar to some of those which he describes. Since Powell's description the literature of the Flagstaff ruins has been confined mostly to popular newspaper articles, archeologists seeming to have paid little attention to this neighborhood.

The cavate rooms near Flagstaff are excavated in the lava, or volcanic breccia, and may be classified as (1) cavate rooms with vertical entrances, and (2) cavate rooms with lateral entrances. The former are well illustrated by the "Old caves," 9 miles east of Flagstaff; the latter by the "New caves," 12 miles from the same place, in the same direction, and by cavate rooms half a mile west of Turkey tanks. These two types of cavate rooms are similar, and their former inhabitants were apparently of the same culture. Major Powell learned from the Indians of Cataract canyon that the ancestors of the Havasupais occupied these cavate houses, and he states that "they doubt-

^a Probably the "cascades" were the Grand falls, miles above the Black falls.

^b See Seventh Annual Report of the Bureau of Ethnology, 1891.

less lived on the north, east, and south of San Francisco mountain at the time this country was discovered by the Spaniards, and they subsequently left their cliff and cavate dwellings and moved into Cataract canyon, where they now live."

The fragments of pottery seen about the entrances to these caves are identical with those found near the pueblo ruins in the neighborhood, and there is no doubt that the cave inhabitants had burrowed in the lava as the most practical means of constructing habitations in this neighborhood. Free walls are found in combination with the caves, but these walls have no distinctive characteristics, save that they are built of lava. This would indicate that the builders simply utilized readily available building material and took advantage of peculiar geological conditions.

OLD CAVES

The "Old caves" lie near the top of Old Cave mountain, about 9 miles northeast of Flagstaff, and cover an area of about 5 acres. On the top of this height there is a level space which was surrounded by a rough wall made of volcanic breccia, from which a good view can be had of the surrounding country. The caves are found on the southern slope, and were excavated in a conglomerate of cinders or volcanic breccia which bears every evidence of having been erupted from a crater or blowhole (plate 1). Clambering over the rough lava blocks, one finds everywhere on the surface the remains of walls indicating former rooms. In places there are level spaces which seem to have been plazas, and the entrances into the subterranean rooms often open vertically from these levels. At other points it would seem as if the walls formed complete rectangles, but there is no apparent evidence that they had roofs, which, however, may have existed in former times. In fact, the Old caves show combinations of underground cavate rooms with free walls above, and when inhabited the settlement must have looked like a collection of low one-story rooms continuous for several hundred feet. We may therefore call this cluster of cavate rooms a pueblo in which each room above ground had a corresponding subterranean chamber hewn out of volcanic breccia.

One of the best-preserved and most characteristic rooms of the old caves, with a vertical entrance, is shown in the accompanying plan (figure 3). It will be seen that there are two subterranean rooms, A and B, each of which is entered by an opening in the roof, indicated by a dotted line. Room A measures 12 feet each way, and the entrance measures about 6 feet. This entrance has a square enlargement, or chimney, on one side, which extends to the floor of the room and has perpendicular, regular walls.

At one corner of room A there has been hewn out of the lava a small recess (E), the floor of which is lower than that of the room. There is also a small recess (F) at one side of the chimney.

Room B is larger than room A, being about 16 feet square. It communicates with room A by a broken doorway, and has an opening through the roof. The floor is somewhat lower than that of A. A recess (D) on one side of this room also communicates with the outside by a small opening which bears the same relation to room B that the flue F does to room A.

Room C is an oblong, irregular, subterranean chamber, 5 by 7 feet, with passageways into rooms A and B. The opening into A is almost perfectly square, that into B less regular. Its floor is several feet lower than the floors of the two other large rooms in this cluster. There are evidences of clay plastering in several places, and appar-

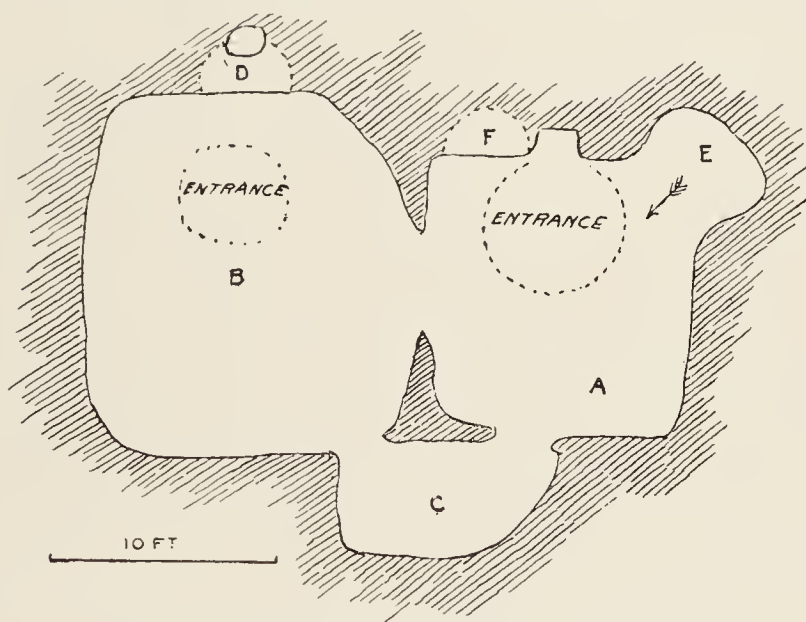


FIG. 3. Plan of an "Old cave" dwelling.

ently the floor, walls, passageways, and possibly the roof, were smoothly finished. The plastering has, however, fallen, exposing the rough lava corners.

NEW CAVES

The mountain in which the New caves occur is about 3 miles west of Turkey tanks, or about 12 miles east of Flagstaff. This height is interesting from a geological point of view, it being a section of the rim of an old crater, as may be seen from its summit. The remaining portion of the crater rim, that on the eastern side, has been eroded into hills, the relation of which to the crater is recognized only by their positions. The highest part of the rim, that in which the caves are found, is the western wall of the crater, which, with an adjacent southern section, forms a crescent connected by a ridge of less altitude. The more northern of these elevations is the higher, and the cavate rooms occur on its eastern side.

From the west the ascent to the mountain, though steep, is not difficult, the trail passing stunted cedars growing on a mass of cinders. In the depression between the two hills which form the crescent we find rows of volcanic breccia fragments arranged in rectangular and other forms, suggesting a reservoir. From this point the ascent becomes more difficult, and as one reaches the top of the higher hill he finds himself on the rim of a former crater. On the east the rim rises almost perpendicularly, and its walls on that side are outcroppings of exceedingly rough cinder conglomerate. In this almost perpendicular wall, facing what may have been the middle of the former crater, tier upon tier of cavate rooms (plates II, III), irregularly arranged and very difficult of approach, have been excavated. The crest of this, as well as of the adjacent lower section of the crater rim, is capped by artificial walls of considerable height, indicating former houses. The whole aspect of the place is one of desolation, and the lava appears as if it had been molten but a few generations ago. It may have been great stress or danger which drove the aborigines to seek homes in this forbidding locality.

TURKEY TANK CAVES

About half a mile west of Turkey tanks (about 15 miles east of Flagstaff) there is a collection of cavate rooms with lateral entrances arranged in tiers. These caves, although not so numerous as the New caves, are comparatively well preserved. They are situated a short distance to the left of the road from Flagstaff on the uplifted outcrop of what appears to be an old volcanic blowhole, and are confined to the northern side of the depression which marks the former place of eruption (see plate IV).

The outcrop on this side of the depression is composed of alternate layers of hard lava and volcanic breccia. The former would tend to resist any working with primitive implements, but the latter could readily be excavated with stone tools. The average thickness of the layers is about 8 feet. By the excavation of the breccia the layer of harder lava above it has been undermined and has now fallen in places, filling the rooms or closing their entrances so that the form and dimensions are no longer determinable. As the layers are uplifted, vertical entrances into these cavate chambers are absent, the doorways entering horizontally from the side of the cliff. There are at least three tiers of these rooms, corresponding with the strata of volcanic breccia.

In some of these cavate rooms there is a combination of stone walls and excavated chambers, the rooms having been separated laterally by a plastered wall of small boulders brought from the bottom of the adjacent depression. Apparently, also, walls formerly existed in front of the entrances to the caves, but of these the greater part have fallen, and their outlines are difficult to trace except in small sections.

Entering by a side opening, one passes into a subterranean room (plate v) 12 by 10 feet and 6 feet high, the walls and floor of which are partly plastered. This room has five smaller rooms leading from it, which will be called B, C, D, E, and F. They average about 5 feet in diameter, and have their floors depressed about a foot below that of the main room, A. The entrances into these lateral rooms, especially that into D, are carefully made and almost square, and when plastered, as there is good evidence that they once were, made good doorways. In fact, although the walls of most of these cavate chambers are now very rough, and the rooms seemingly desolate as places of habitation, they must once have been comfortable abodes, for the plastering made the finish almost as smooth as that of any wall which could be constructed.

Several of the rooms in which the plastering still remains have ledges and cubby-holes in which the household utensils were doubtless kept (plate vi). The similarity of these cavate chambers to those excavated in volcanic tufa in Verde Valley is apparent. The material in which they occur is different, but the plans of the rooms are almost identical. Whatever peoples inhabited the cavate dwellings of the cinder cones near Flagstaff and the tufa mesas of the Verde, their culture was not radically different.

RUINS NEAR BLACK FALLS OF THE LITTLE COLORADO

LOCATION AND PREVIOUS EXPLORATION

It has long been known that the banks of the Little Colorado and neighboring mesas were sites of ancient dwellings, but exploration has been confined mostly to the upper part of the river and its tributaries. The numerous ruins along the stream from Grand falls to its confluence with Rio Colorado have been wholly neglected, but there is little doubt that future excavation will be rewarded with many novelties.

The Black falls ruins have been known for several years to local amateur archeologists, and a considerable collection of ancient objects has been taken from them by Mr Benjamin Doney, of Flagstaff. Under his guidance several well-known residents of that town, among whom may be mentioned Dr Robinson and Mr Jack, have visited and photographed them.^a Herders and cowboys are acquainted with the ruins, and the former have cleared some of the rooms for use in winter.

The geological features of the region in which these three groups of ruins occur are instructive, but for present purposes one or two simple statements about them will suffice. The two well-marked formations—lava and sandstone—have affected the appearance of the ruins.

^aThe author was guided to these ruins by Mr Doney. He is indebted to Dr Robinson and Mr Reed for kodak photographs, and to Mr Jack for measurements of several rooms.

The black lava covers the red sandstone, forming great mesas or isolated buttes, the summits of which are crowned with ruins. The lava ruins have low, rough walls, in which adobe mortar was not detected. The red sandstone formed a more tractable material, and the buildings constructed of it show fine masonry with adobe mortar. These ruins ordinarily stand on the brinks of small canyons eroded in the sandstone, on isolated blocks of the same stone, or on ridges left by erosion. If these lava and red sandstone ruins were found in different localities they might be regarded as products of different peoples, but their existence side by side in this region shows that the slight differences in their architecture were due simply to the building materials employed. The irregular forms of the lava blocks made it impossible to construct from them the fine rectilinear walls which were possible with the well-squared blocks of sandstone. The erosion of the lava produces a coal-black, porous sand, which as a rule covers the finer red soil derived from the sandstone. This soil, drifting into pockets or depressions in the surface rocks, afforded burial places for the inhabitants of the villages.

This region has few trees; there are no pines, and only a few cedars. It is the same sagebrush country which we find near the upper Little Colorado at Holbrook and Winslow.

The region is arid; it now has few springs, those which were used in ancient times having probably been filled by drifting sand.^a Volcanic agencies have left their mark on the whole region, causing in places deep fissures in the rocks, into some of which a strong current of air continually passes, and from one of which emerges a roar as though of subterranean currents of water. One of the largest of these fissures is about 2 miles from the Tuba road, on the way to the ruins called group A; others are found in the rocks near ruins G and H of this cluster, where their depth has not been determined. These crevasses, which are no unusual feature in the geology of this region, vary in breadth from a few inches to many hundred feet, and from a hundred yards to miles in length. When very broad they form canyons which end abruptly or merge into "washes" as the configuration of the country may dictate.

GENERAL FEATURES

The ruins near Black falls are as a rule rectangular in form, with similarly shaped rooms of one or more stories. Curved walls are rare, although in some instances the shape of the ruin follows the curvature of the mesa on which it stands. As has been stated, the ruins are built of both sandstone and lava, and the two varieties are found in close proximity, sometimes within a few hundred feet of

^a The author does not share a common belief that when these now ruined structures were inhabited the precipitation was greater. In an arid region springs are rapidly filled by drifting sand if not dug out repeatedly. The Hopis are obliged to clean out some of their largest springs annually.

each other. The character of the sandstone of the region is such that when the stone is fractured slabs are produced which make possible the construction of excellent walls. Blocks of lava, however, have no flat faces, and their use as building material results in poor masonry, for the adobe mortar readily washes from the joints and the walls soon fall. It is rare to find houses built of lava which now stand many stories high. The best rooms constructed of lava contain also sandstone slabs, which have strengthened their walls, as in the "Citadel" of the Black falls ruins, where blocks of sandstone were also used as lintels. None of the walls show evidence that the building stones were dressed after being quarried.

The sites of these ruins are ordinarily elevated, and it is not uncommon to find an entire mesa top either covered with rooms or surrounded by a wall.

The highest walls of these pueblos were as a rule situated on the north and west sides, the pueblos being terraced on the south and east. This arrangement was apparently adopted to secure sunny exposure.

The ground-floor rooms had no lateral external entrances, but where there were several chambers side by side they communicated with each other by doorways. In the case of two or three story houses, it is probable that the ground floor was used for storage and was entered from the roof. This is an architectural feature still retained in the old Hopi houses, but it has been somewhat masked by modern buildings erected in front of them. The old houses of Walpi, Sichumovi, and Hano had ground floors which were entered from the roofs, to which one mounted by ladders, while entrance to the second story was gained by means of a side doorway from the roof of the first. Many of these old rooms are still to be seen at Walpi, especially around the plaza, and there are one or two examples in the villages of Sichumovi and Hano.^a The oldest houses of Tusayan never had lateral entrances from the ground floor, but when the first story was occupied it was provided with a hatchway in the roof. This type of room, however, is rapidly disappearing, the majority of ground-floor rooms on the East mesa now being provided with doorways in the walls. On the Middle mesa and at Oraibi the number of ground-floor rooms entered by a side door is still smaller than on the East mesa. It may safely be laid down as a rule that whenever in the Hopi pueblos one finds rooms on the ground floor entered by lateral doors, the construction is new.^b

^a A good example of the ancient houses of Walpi, in which the lower story serves as a dwelling room at certain times, is Saliko's home, near the Snake rock, and the row of rooms from Honsi's house to the Moñ kiva. The Flute house is also a fine example of this type. In Sichumovi the house of Pütce illustrates this ancient type, and there are several examples of it in Hano, of which Kalacai's house is a good one.

^b The author will consider this architectural likeness of the ground rooms of the ancient ruins to old Hopi houses in his final article on the Black falls ruins, where plans will be given illustrating the relation of the ground-floor rooms with lateral doors to the old rooms on the East mesa. The ruins near Black falls have their ground-floor rooms like the old rooms of the Hopi pueblos.

In many of the ruins there are found at the base of the mesa on the south and east sides rooms of a single story which, from their position, we may designate basal rooms. They are now covered with débris, but were once protected by the overhanging edge of the mesa, suggesting cliff houses, of which they may be a survival. These basal structures may have been used as granaries, but in none of them were remains of roofs found.

With the exception of ruin A, group B, most of the ruins show little evidence of long occupancy; few logs or beams remain in them, there are no extensive deposits of débris, and there is a lack of large quantities of pottery fragments such as are usually found about pueblos which have been occupied for many generations. The general indication is that these buildings were inhabited in comparatively modern times.

None of the rooms show marks of surface plastering, except those of group B, where it is confined to the interior of the walls, as is the case with the older Hopi buildings.

The size of the rooms is much greater than is common in very ancient ruins. No kivas are found, and it is believed that the religious ceremonies were held in the ordinary domiciles. No building had a roof intact, but in many instances the remains of the roofs and floors of the upper rooms were found in the chambers below.

The fact that wooden beams occur so abundantly in ruin A, group B, implies that it was either the last pueblo to be abandoned in this neighborhood or that the beams were taken from the others to it, and when it was deserted its inhabitants moved too far away to carry heavy objects with them. Some of the timbers in the modern Hopi houses are said to have been dragged from the Little Colorado, possibly from old ruins.

GROUP A

Group A includes a cluster of ruins which as a rule are small and have a general similarity in construction. It is situated about 15 miles west of Little Colorado river. Following the road from Flagstaff to Tuba to within about 11 miles of Tanner's crossing, after passing Deadman's flat the visitor turns to the right, and, proceeding 4 miles eastward, finds himself in the midst of the group. There are no trails or wagon tracks from the well-traveled Tuba road to group A, but the country is so level that one can readily go overland to almost any point. A castellated, truncated lava cone, the "Citadel" of the group, can be seen soon after one leaves the Tuba road, and this prominent landmark gives the general direction of the ruins among which it is situated. From the top of this citadel all the ruins of group A, with one or two exceptions, are visible, and the visitor is advised to inspect it first in order to determine the position of the surrounding ruins (see plate VII).

THE CITADEL

The walls of the Citadel (figure 4) are constructed of blocks of lava and sandstone, and cover the top of a truncated elevation. They are arranged about a level central court or plaza, the surrounding walls of which are best preserved on the western side. The hill on which the citadel is built bears evidence of having once been a volcanic cone, and was an advantageous place of refuge for the inhabitants of the neighboring houses, as it had a commanding position, was difficult of access, and was well fortified. As some of the structures were of two stories, they appear to have been permanently inhabited.



FIG. 4. The Citadel, group A.

Twenty-three small ruins were counted from this elevated position (see plate VII). For convenience of description these may be designated A, B, C, etc.

RUIN A

Ruin A of group A is situated at the base of the truncated mesa of the Citadel. It is built of red sandstone, with a few courses of lava blocks, is 50 feet long by 12 feet wide, and contains five rooms arranged side by side. Although the house was evidently never more than one story high, the many fallen building stones would seem to indicate that its walls were once considerably higher than at present. Few floor beams or rafters were detected.

Near this ruin, at the base of the hill, are four walled inclosures, one above another, suggesting terraced gardens. Their low walls are composed of alternate rows of lava and sandstone. Near these former gardens is a depression which may once have been a reservoir. This ruin is the only one visited which was not built on an elevated mesa at or near the edge of a canyon.

RUINS B, C, AND D

There are remains of three houses, built of lava and sandstone blocks, on a small lava hill a few hundred feet north of the Citadel. On the same elevation there is a circular wall which may have served as a fortification. Most of the walls of the ruins have fallen, and it is almost impossible to determine the relationship of the former rooms. There are also some small ruins on a lava hill near the elevation on which B, C, and D are situated.

RUINS E AND F

A considerable distance from the last-mentioned cluster, but in the same direction from the Citadel, there are situated two conspicuous ruins visible from a considerable distance. One of these, on the top of a lava mesa, is built of the same material of which the mesa is composed; the other, situated at its base, is constructed of red sandstone. Near the latter, on a lava mesa, there are many pictographs, representing spirals, frogs, snakes, and unknown figures. There is much broken pottery near ruin F.

RUINS G, H, I, AND J

These ruins, especially G, H, and J (plates VIII–XI), are constructed of limestone, and are situated on the brink of a canyon, at the bottom of which, near ruin G, are mounds indicating the site of I. The walls of G, H, and J are well preserved, and show some of the best aboriginal masonry in Arizona.

Ruin G (plate VIII) had two rooms with walls rising 20 feet from the rim of the canyon. The lower courses of the walls are much larger than the upper, as is true of others in this neighborhood. The level of the floors is indicated by courses of larger stones.

Ruin J (plates X, XI, figure 5) is the best preserved of all the ruins in group A, and presents exceptional features. It is situated on the left wall of a canyon which is about 40 feet deep and equally wide. It deepens and widens east of the ruin, and then narrows, forming a natural corral inclosed by cliffs. Eight good rooms were noted in that part of the ruin situated on the top of the canyon wall, and in the canyon below it there were several semicircular basal rooms, some of which were sheltered by an overhanging cliff. Similarly sheltered rooms are found in many of the ruins in this neighborhood, but nowhere else are they so well preserved. There are no beams in

place, but their former positions are shown in many walls by openings, indicating that when inhabited the pueblo had two, possibly three, stories. An inclosure which may have been a ninth room is so filled with fallen walls that the details of its construction or size could not be determined.

As none of the rooms have external lateral openings on a level with the foundations, it is naturally supposed that all were entered by means of ladders and hatchways. There are a modern doorway and fireplace in one room, evidently of later construction than the walls.

Perhaps the most problematic structures in this ruin are the small eysts in the canyon walls east of the entrance. A thin layer of softer rock has so weathered as to leave a horizontal crevice which at intervals is divided by stones set on edge into receptacles a foot or so deep. They were formerly closed by flat slabs of stone, only two of which now remain in place. These eysts were nicely plastered, and the slabs which closed them were luted in place with adobe. Nothing was found in them to indicate their use, whether as burial

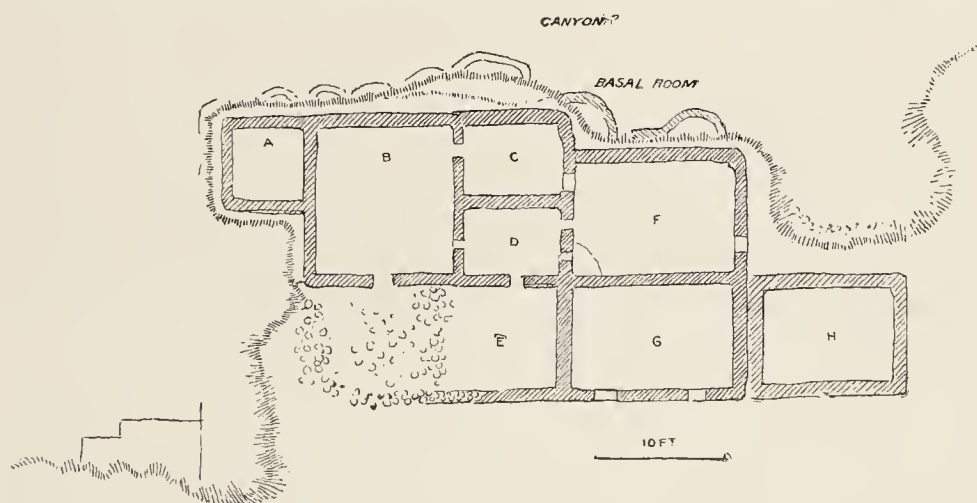


FIG. 5. Plan of ruin J, group A.

places for the dead or as bins for the storage of corn. Their number was considerable, but they were so small that their capacity could scarcely have been more than a few bushels. This is the only ruin in which such inclosures were found, and no theory is advanced as to their former use.

RUIN K

Ruin K, which evidently formerly contained several rooms, is divided into two sections and is situated on a high lava mesa difficult of approach. The walls of the larger section inclose three well-preserved rooms, and still rise to a height of about 8 feet. Five feet above the base the red sandstone blocks of which the walls are built are replaced by a course of stone of lighter color, which forms a horizontal band around the ruin. The second section consists of a low, rough wall built along the edge of the cliff, inclosing a level space in

front of the first section. There are isolated rooms in this inclosure, and a depression which may have been a reservoir. This ruin, like many others, consisted of dwellings and a fort for protection. There are instructive pictographs on the rocks near by.

RUIN L

At the base of the mesa on which the last-mentioned ruin stands is a ruin of red sandstone with five rooms and a foundation of unusual shape. A huge rock, cubical in form, has fallen a few yards from its former position in the bluff. Ruin L is built on the top of this detached block, and its fairly well preserved walls are separated



FIG. 6. Section A, ruin A, group B.

from the bluff on all sides by a wide crevice. From a distance the ruin appears to be perched on the bluff, but closer observation shows its separation from the latter by an impassable natural moat.

RUIN M

This is an oblong ruin rising from the side of a deep, narrow canyon, with walls consisting of alternating courses of large and small blocks of red sandstone. Some of the walls have fallen, but sections fully 10 feet high still remain in place. There are evidences of five rooms, each two stories high, but most of the chambers are

filled with fallen stones. The cemetery of this pueblo lies west of the ruin, where there are also remains of walls.

Small ruins may be seen near the road from group A to group B, a few miles to the left. Their walls are in good condition, but no peculiar features were observed.

GROUP B

RUIN A

The largest of all the ruins in the Black falls cluster, and one which bears evidence of having been inhabited for a considerable time, lies about 35 miles northeast of Flagstaff and about 8 miles from the Little Colorado. This structure is built on a ridge of sandstone extending in a northeast-southwest direction, and consists of two large buildings of moderate elevation (plates XII-XVI, figure 6). On each side the ridge slopes gradually to a depression, the talus on the

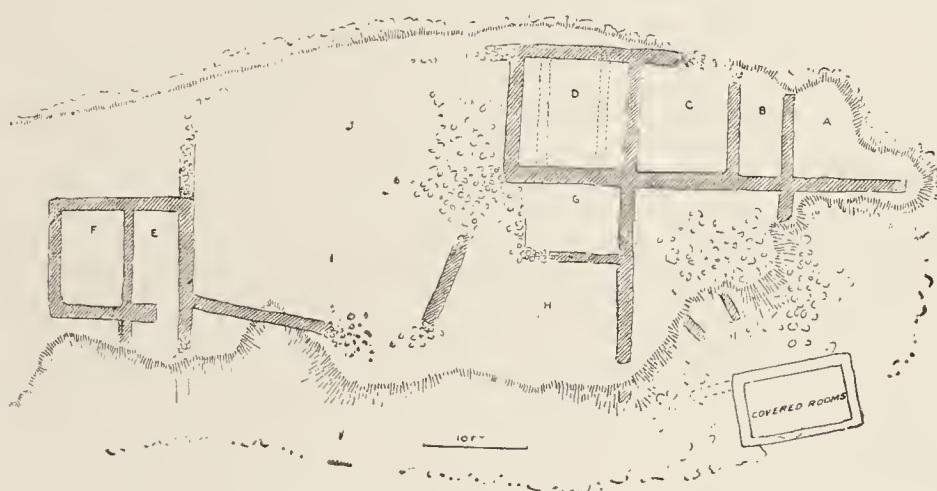


FIG. 7. Plan of section A, ruin A, group B.

east covering a series of rooms, while on the west side, where the slope is more abrupt, no rooms were discovered. The ruin is divided into two sections connected by rows of one-story rooms, the walls of which have fallen. Remains of a great number of roof and floor beams are still scattered throughout the débris. These beams are larger than those in any other ruin of the same size known to the author.

It is difficult to determine the original number of rooms in the first section of this ruin, as the tops of the walls have fallen, filling the chambers with débris. How many basal rooms were buried in the talus of fallen walls at the base of the mesa on the eastern side could not be discovered. Room A of this section (see figure 7) is elevated on a rocky base about 10 feet high. The chamber is small, and its walls have fallen on two sides. The débris has been cleared out of this room by Mr Doney, who found in it the desiccated remains of an infant wrapped in four well-preserved cotton blankets.

Room B is a small, narrow chamber with good walls on three sides, but the fourth wall, which was situated on the edge of the mesa, has fallen over the brink.

The ground-floor chamber of room C is formed by a gap in the mesa, from which a large cubical block has fallen. The walls of this chamber are the natural rock, to the surface of which adhere fragments of plastering. The beams of the floor of an upper room still rest on the edge of the gap, as in some of the kivas of Walpi to-day, especially those on the eastern edge of the mesa. These are built in a depression, the solid rock forming the walls on three sides, the fourth wall being of masonry.

Room D is buried under débris, and the broken beams, which have pressed down on a plastered banquette, are still visible. The reeds, straw, and impressed clay which once formed a floor may be seen in section.

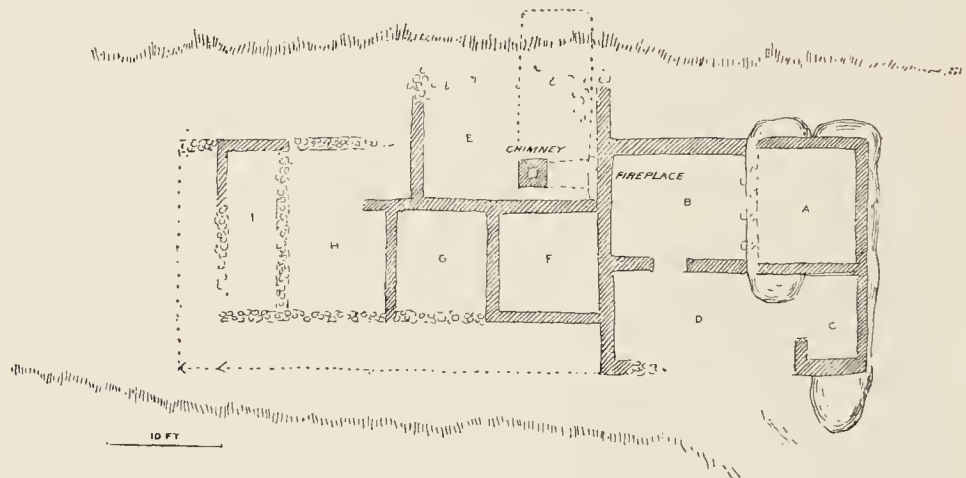


FIG. 8. Plan of section B, ruin A, group B.

Room E has two stories, and the floor beams and rafters are still in place but buried under débris. A high wall extends from the eastern wall of room E, crossing a depression in the cliff, which is bridged by logs serving as its foundation.

It seems within the bounds of probability that there were 30 rooms in the first section of ruin A, group B, including the basal rooms now deep beneath the fallen walls of the higher portion of the ruin. On the supposition that half of these were uninhabited, and that there were four persons to each room in the remainder, the first section of the ruin would have housed a population of 60. This, however, on the basis of the present population of Walpi, as compared with the number of rooms in the pueblo, is a rather low estimate. Considering the population of the second section as about the same as that of the first section, and that of the connecting rooms as about 30, the approximate population of the pueblos would have been 150. Estimated on the basis of that of Walpi, the population would be 200.

The rooms of the second section (figure 8), several of which are well preserved, are lower than those of the first section, and the detritus has covered the base so completely that the mesa is inconspicuous. Room A (plate XIV) is nearly square and is built on two rectangular rocks, the top of which forms the floor. One of these rocks forms a side of the lower story of the adjoining room B, which is in the best condition of any in this section. The walls of this room are well preserved, and it was occupied as a habitation by a herder a few winters ago. There is a lateral doorway through the wall on one side, and in one corner is a fireplace communicating with a chimney, which will later be described. This room is 12 feet 4 inches long by 9 feet 7 inches wide. In the second section many walls are still standing high above their foundations, indicating rooms now filled with fallen debris, in which beams, fragments of pottery, and other objects may be seen. Ten large rooms were counted, several of which had two stories. As has been stated, there were apparently basal rooms on the eastern side. The entire section is about 60 feet long.

A chimney-like structure (plate XV) is one of the most conspicuous objects in this part of the ruin. It rises from the mass of debris covering room E and communicates with the fireplace in room B, but a vertical line from its top is 7 feet 10 inches from the nearest wall of the room in which the fireplace is situated. Whether this chimney is aboriginal or not, or whether it is a chimney at all, are open questions. Excepting its state of preservation and fine masonry, no evidence was found that it is of more recent date than the walls of the rooms. If it is an aboriginal chimney, which is doubtful, its structure is unique. It may be a ventilator, comparable with the chimney-like structures described by Mindeleff in the kivas of Canyon de Chelly.

One of the finest reservoirs (plate XVI *a*) which the author has seen in connection with a ruin was discovered near the bottom of the elevation on which ruin A of group B is situated. This reservoir is circular in shape, 50 feet in diameter, and carefully walled. It lies south of the second section of the group, and apparently had a break in the wall in line with the depression east of the ruin. It appears to belong to the same type as those reservoirs on the East mesa of the Hopis in which snow and rain are collected for future use.

There are instructive petroglyphs near ruin A, group B. A number of rock etchings observed in a small canyon about a mile from the ruin were pecked in a perpendicular wall, protected by the overhanging rim of the canyon. These petroglyphs were evidently made by the former inhabitants of this region, as one of the best examples shows the same design as that figured on pottery from the neighboring ruin. There were likewise butterfly, sheep or antelope, and other figures.

It would be quite impossible in this preliminary notice to give a complete account of the archeologic objects which Mr Doney has taken from this ruin, but even a preliminary sketch would be incom-

plete without some reference to them. One of the most important objects is the desiccated body of an infant wrapped in coarse cotton cloth, allusion to which has already been made. This bundle was inclosed in three small cotton kilts which were later washed and found to be "as good as new." At the foot of the infant was a desiccated parrot (?), some of the brilliant plumage of which is still to be seen. This bird has a prayer stick tied to one leg, which makes reasonable the belief that it was a ceremonial object. Another interesting specimen in the Doney collection is the dried body of a dog, which was found in one of the deep clefts in the rock near one of the ruins. This dog has a head similar to that found by the writer in the Chaves pass ruin. There are also several fragments of beautiful cotton cloth and netting. Some of the specimens are embroidered, others are painted with circles and other geometric designs. A heavy wooden club, several planting sticks, and other wooden objects are to be seen in Mr Doney's collection. There are also many cigarette canes, some with woven handles, as well as seeds of cotton, squash, gourd, and corn, and many objects of shell, as tinklers, ornaments, rings, and bracelets. One of the best *Haliotis* shells the author has ever seen from a ruin was found in one of the graves.

There are also many large turquoise ornaments, some an inch or an inch and a half square. The many metates are made of lava, and are deeply worn, as if from long use. A copper bell from a grave near ruin A is a remarkable specimen. It has the same form as the bells from Arizona ruins, which the author has elsewhere described, but on one side are ridges indicating eyes, nose, and mouth, apparently made of strips of metal soldered or brazed to the surface. It is not believed that this bell was the product of the former occupants of these now ruined structures; more probably it was obtained by them through barter.

RUIN B

Across the depression north of ruin A, beyond the reservoir and on top of a mesa, there is a rectangular ruin consisting of two sections connected by low, parallel walls, which inclose a rectangular plaza. It appears that each section was composed of two single-story rooms. No beams or other evidences of roofing are now visible, but a considerable quantity of masonry has fallen into the inclosures. From the base of the mesa to the ruin an old trail can be traced by rows of stones on the eastern side, and on the same side there are likewise remnants of rooms. Graves were found among the rocks at the base of the mesa.

RUIN C

About half a mile north of ruin A of group B there is a fortified mesa with several rooms, some of which had two stories. The surface of this mesa is flat, the rim is round, the sides are perpendicular, but

of moderate elevation. Most of the walls built on the rim, continuous with the mesa sides, have fallen, but sections of the houses 10 feet high still remain, and the roof beams and wattling may be seen in place in one or two rooms.

There are some fragments of broken metates made of lava, many potsherds, and a considerable pile of débris at the base of the mesa. Ruin A can be seen from the highest point, and the distant ruin A of group C is plainly visible. The cemetery is on the east side, among the rocks at the base of the mesa.



FIG. 9. Ruin A, group C, from the south.

GROUP C

RUIN A

This ruin, which lies 40 miles by road from Flagstaff and 5 miles due west of Black falls, is one of the most impressive masses of aboriginal masonry in this section (plates XVII-XIX, figure 9). It is visible for many miles, and from a distance resembles an old castle as it looms from the north end of an isolated, oblong, red-sandstone mesa rising 15 feet above the plain. The south end of the mesa is higher than the north extremity, and on its rim appears to have been built a low wall inclosing a plaza. Standing walls cover about one-half the surface of the mesa. On its east side, about midway of its

length, there is a gap with perpendicular walls extending about 14 feet into the side and almost bisecting it.

The following measurements of ruin A, group C, were made by Mr Jack, who has kindly placed them at the author's disposal:

The longer axis of the mesa bears north 10° east (the bearing was obtained by using the face of the eastern wall of the highest building). The width of the mesa at the middle point, measured from the rim of the overhanging cliffs, is about 65 feet. The height of the tallest wall of room A is 19 feet above its foundation, on top of the mesa, which is about 15 feet high. The inside measurements of the same room are: Top of mesa to probable position of first floor, 7 feet 6 inches; first floor to probable position of second floor, 8 feet; bench on which the floor beams of the second floor rest to the top of the

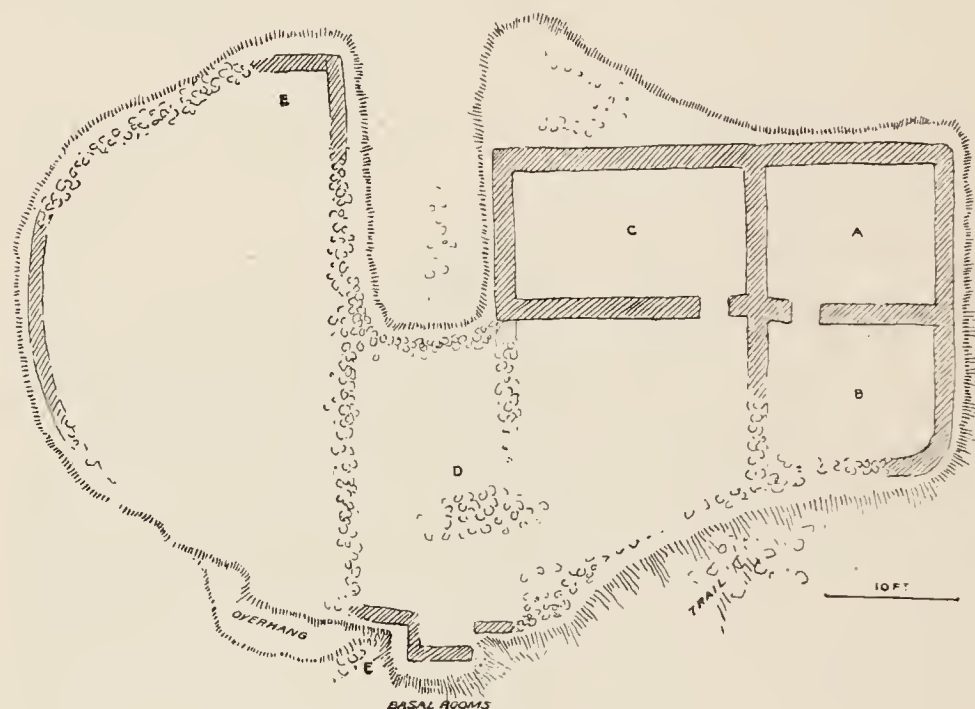


FIG. 10. Plan of ruin A, group C.

wall, 3 feet. It may reasonably be concluded that the third story was as high as either of the other two, or about 7 feet 6 inches, which would make the original height of the wall about 23 feet.

The inside horizontal measurements of the north and south walls of room A are not the same. The former is 11 feet 4 inches, the latter 9 feet 9 inches. The east and west walls are 12 feet long. Room C is 17 feet 9 inches long by 9 feet 7 inches wide.

Although the standing walls of this ruin are the best preserved of any of those examined, no wooden beams were found in place, nor were there remnants of the flooring or other débris in the rooms themselves. This absence is explained by the supposition that at the time of the abandonment of the settlement, or later, the woodwork was carried away for use in new habitations. Possibly they were taken to

ruin A of group B. There is good evidence that this ruin once had large floor beams, as is indicated by openings in the walls in which they rested.

Examination of the ground plan (figure 10) shows that the whole surface of the mesa was once covered with rooms, the walls of which still extend to its edge. The highest walls, those which surrounded room A, are three stories. The two outside walls rise directly from the edge of the perpendicular cliff. There are several small openings at various levels, and holes in which rested the great beams that once supported the flooring are readily seen. At the corners of the rooms the masonry of the second story is bonded to that of the first and third, imparting solidity and strength to the high walls. There is no entrance or passageway between rooms A and C, but access was had to room A from room B. Room B is almost perfectly inclosed by standing walls, formerly two stories high. The wall on the north side has been overturned, and the many stones which have fallen at the base make an entrance at this point possible. As is shown by the depressions in the walls, this structure once had two large beams in the roof of the first story, but they have disappeared. Room C has one story; its walls are complete on all sides, and there is an interior entrance into room D, and an exterior passageway. Rooms A, B, and C are conspicuous from a distance and form the greater part of the ruin. At intervals on the rim of the mesa other walls are found, some sections of which are 4 or 5 feet high. It is difficult to trace the walls of the rooms designated D and E. This ruin also has cave rooms at the south base of the mesa, which recall those of the other ruins in the Black falls cluster.

Plate XVII shows ruin A, group C, from the east. The tall, square tower on the left of the plate incloses room A, and the lower wall extending to the gap is the side of room C. The fragments of masonry on the right of the gap are all that remain of the walls of room E. The mounds on the mesa to the right of the last are remnants of an encircling wall and of rooms which once surrounded the open space on the end of the mesa. On this side of the mesa the upper part overhangs the lower, forming a cave, but no indication of rooms was detected here.

The wall on the edge of the mesa which shows at the left of plate XVIII is a part of room D, and at the bottom of the cliff at this point can be seen the walls of the basal rooms built at right angles to the cliffs. These are also shown in plate XIX.

The cemetery is about 100 yards east of the ruin and is small in extent. The mortuary objects found in a single grave opened will give an idea of the burial deposits. The graves are oval, and consist of cysts made of slabs of stone set on end and covered with other flat stones. The upright stones were cemented together with adobe, the covering slabs being apparently luted to the edges of the uprights. These burial cysts were commodious, and in the one uncovered the

body, which was that of a woman, lay on one side, at full length, with the head at the wider end. To the right of the hips were found a decorated food bowl in which was a smaller bowl, a large and beautifully decorated vase, and a second small food bowl. On the left arm was an armlet made of a *Pectunculus* shell identical with those found in the ruins of Homolobi. On the breast there was a remnant of a wooden prayer stick painted green. Near the mastoid processes were square ear pendants made of lignite covered with a turquoise mosaic surrounding a central red stone. These are beautiful specimens of turquoise mosaic, far superior to those now in use in the Hopi pueblos. The skeleton was in a very poor state of preservation, probably because of the character of the soil, which is a cinder sand through which water readily percolates. There is a general similarity in the texture and decoration of the four pieces of pottery found in this grave. They belong to the black-and-white variety and have geometrical ornamentation.

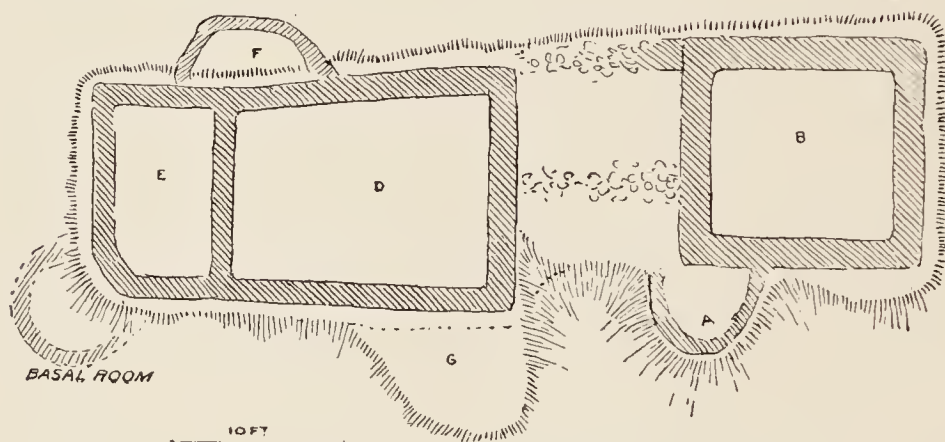


FIG. 11. Plan of ruin B, group C.

RUIN B

About 2 miles from the large ruin just described, to the left of the road to Schültze's spring, is a small red-sandstone ruin standing on an isolated bluff. This ruin covers the top of the mesa, and is conspicuous for some distance. The rim of the mesa overhangs in places, as the lower strata are much eroded, and the ruin can be entered at only one point. All the rooms of this ruin are single storied, and most of the walls are high, though there is a considerable quantity of fallen stone in the rooms and at the base of the mesa.

Room A (see figure 11) is a semicircular inclosure most of the walls of which have fallen. It is perched over a projecting table or platform, the rim of which the wall covers. The ground plan of room B is nearly square; the walls are well preserved and rise directly from the edge of the mesa, which is steep on three sides. The interval between rooms B and D is strewn with stones, but traces of low walls can be seen. One of these walls is on the edge of the steep mesa; the

other, parallel with it, almost divides the space in halves. This is the part of the ruin which one enters first after climbing up the talus of fallen rocks. Room D is large, with well-preserved walls 4 or 5 feet high, and with a projecting platform on one side, on which only obscure indications of artificial structures may be detected.

Room F is rather small, with walls built over a projecting platform, resembling from below a bow window. Room E is well constructed; it contains considerable debris, and its sides are continuous with the perpendicular wall of the mesa. At the base of the cliff, just below room E, there is a low, almost circular wall, forming an inclosure somewhat similar to the basal rooms of some of the ruins already described. Although in general its architecture does not differ from that of many other rectangular ruins previously discussed, the overhanging platform gives a unique appearance to the structure. About 300 feet eastward were noted the edges of flat stones which indicate burial mounds. The whole length of this ruin is 46 feet, and the width, including the projections at F and G, 21 feet. The sizes of different rooms measured were:

Room B, 10 feet 8 inches by 9 feet 10 inches.

Room D, 15 feet 4 inches by 10 feet 5 inches.

Room E, 10 feet by 5 feet 10 inches.

The following bearings were taken from this ruin:

Group C, ruin A, bears north 12° east.

Mount Agassiz bears south 48° west.

Schültze's spring bears south 50° west.

RUINS NEAR HONANI'S HOUSE AT BURRO SPRING

The Hopi Indian Honani declared that there was a large ruin on the mesa not far from his house at Burro spring. This ruin, however, was not visited, as Honani was away when the author passed through that country. There is a legend that some of the clans of Shumopovi once lived at this point, which is apparently on the line of migration from the ruins on the Little Colorado to the Middle mesa of Tusayan.^a Honani is a prominent man in Shumopovi, which fact may account for his occupation of land near the Burro spring.

The preceding description will give a general idea of the ruins in this section. It is not possible to compare them with the ruins of Homolobi, where most of the walls have disappeared or have so fallen as to render the original plan unrecognizable. The difference in building material employed in the construction of the pueblos on Cheylon fork of Little Colorado river must have imparted a somewhat different character to the buildings erected there, but there is

^aThe simple existence of a permanent spring of potable water in this part of Arizona may be taken as indicative of ruins in its immediate vicinity, and when such a spring lies on or near an old trail of migration, evidence of former settlements can not be difficult to find. Both Big Burro and Little Burro springs lie on the pathway of migrations of the southern Hopi clans in their journey from Homolobi, and were halting places for longer or shorter periods.

some likeness between the ruins at Chaves pass and the lava ruins near Black falls. In this connection it may be stated that there is also a large ruin near Homolobi built of lava blocks on a lava mesa.

The racial and clan kinship of the former inhabitants of these pueblos is somewhat problematic, but it is quite likely that the people were akin to the Hopis. This is shown not only by the character of the houses, but also by the pottery and various other objects found near them. Both legendary and archeological evidences point to the conclusion that the people who once inhabited the pueblos near Black falls came from the north, and were related to those who once lived in cliff houses and other habitations on the Rio Colorado and its tributary, the San Juan. Hopi legends say that the Snake clans formerly lived at Tokonabi, on the Rio Colorado, and that they migrated southward and built a pueblo about 50 miles west of the present Hopi towns, which they called Wukoki. This pueblo, it is said, still has high-standing walls. The direction and distance of the Black falls ruins from Walpi correspond pretty closely with those given in the legend, and while it may not be possible to identify any single ruin of this cluster as Wukoki, the traditional Wukoki of Hopi legend is not far from Black falls. The tradition that the inhabitants of these ruins came from the north is supported by the close resemblance in character and decoration between their pottery and that of the San Juan ruins.

It might naturally be supposed that there would be a close likeness between the pottery of the Black falls ruins and that of Homolobi, and that kinship once existed between the inhabitants of these pueblos on the same river. Close study, however, shows marked differences, and the author is led to the belief that while both were pueblo people, and, therefore, similar in culture, the clans which inhabited Homolobi were not the same as those which lived in the Black falls villages. The clans which lived at Homolobi came from the far south, through Chaves pass, while those at Wukoki came from the opposite direction. Both evidently sought refuge in the Hopi pueblos, where their descendants now live together. The clans from Homolobi were the Patki, Patuñ, and Tabo (Piba), whose route to the Hopi towns was by a trail which extends directly north past the "Giant's chair." The clans from Wukoki were the Teña and others who migrated almost eastward when they sought their home in Tusayan.

OBJECTS FROM THE LITTLE COLORADO RUINS

POTTERY

GENERAL FEATURES

The mortuary pottery from the three ruins, Homolobi, Cheylon, and Chaves pass, is distinctive and typical, with general resemblances to that from other localities. As a rule it is more varied in character than that from the true Tusayan ruins, Shumopovi, Awatobi,

and Sikyatki, though its decoration has many likenesses to that on the pottery from these ruins. It has seemed best to discuss the ceramic ware of these three localities together, but in so doing it is thought necessary to mention the particular place from which each specimen was obtained.^a

It has been shown in an account of the pottery of Sikyatki, where conclusions were drawn from a large collection, that there was not a single piece of glazed pottery found in that ruin. At Awatobi few such fragments were found, but in the Homolobi and Cheylon ruins there were many glazed bowls, pots, and jars.

The question whether the ancient Pueblos glazed their ware has been answered in both the affirmative and negative, and this difference, no doubt, is due to the want of a good definition of the term glaze. Some of the bowls found at Homolobi and Cheylon have a black vitreous covering resisting a knife point, but which is not the gloss derived from polishing the vessel, but apparently from some salt used in the preparation of the black pigment with which the ware is painted. This glaze, however, has not been detected on any colors but black and green, or on any ware except the red, which is so abundant in both the ruins here described.

It is hardly necessary to consider at any great length the various forms of ancient pottery obtained in 1896, for this would simply duplicate work already published in the author's account of Sikyatki. Moreover, the question of variety of forms has already been amply discussed by others. The mode of manufacture, technique, coloration, and like questions were the first to attract attention of students, and, while by no means exhaustively presented, are treated more extensively than the character and meaning of the decoration. A few types present the various forms of pottery from the ancient ruins, and for a study of form alone the material in our museums is ample. With derivation of symbols, however, the problem is very different, for in a collection of thousands of specimens we rarely find two in which the ornamentation is the same. In a general way it may be said that certain decorative types are followed, but the variations are so many that in attempting to present an adequate idea of ancient ceramic ornamentation it is necessary to describe almost every specimen. Manifestly that would be impossible, and as we need classification in this department of study, the following is proposed.

^a Unfortunately for close study of the lesson taught by Pueblo pottery regarding the migration of the ancient people of Arizona, the ruin from which ancient Tusayan ware was collected is not mentioned in early writings on old Pueblo pottery. Thus, we find specimens from Awatobi, Canyon de Chelly, and Sikyatki given one locality, "Tusayan," and modern Tanoan pottery made at Hano by colonists from the Rio Grande bearing the same indefinite description. Almost all the modern pottery from "Tusayan" in the National Museum is intrusive in that province, and is practically modified Tanoan.

CLASSIFICATION BY COLOR AND SURFACE FINISH

The classification of pottery objects by color and surface finish leads us to refer them to the following groups: 1, Coarse unpolished ware, undecorated; 2, coarse unpolished ware, decorated; 3, polished ware, undecorated; and polished ware, decorated, which may be again divided into: 4, red and brown ware; 5, yellow ware; 6, black ware; 7, black and white ware; 8, red and black ware; 9, red, black, and white ware; 10, white and green ware.

COARSE UNPOLISHED WARE

Although a large collection of coarse ware was made in the excavations, the forms obtained varied little from those described from Awatobi and Sikyatki. Of more than usual interest were specimens of coiled-ware bowls, the interiors of which were black and glazed. These are represented by several specimens from the Chaves pass ruins.

There is but one specimen of rough ware the exterior of which was decorated (see figure 17).^a The rudeness of the design on this object is no doubt in part due to the character of the ware. As we go south the number of these specimens of rude coiled ware with external decoration increases. They are not found in ruins near the inhabited Hopi pueblos, are represented by a few specimens at Homolobi, increase in number at Cheylon, and are well represented in ruins on the northern foothills of the White mountains.

UNDECORATED POLISHED WARE

While in a few cases polished ware was undecorated, this was exceptional, and only a few specimens were found, which all came from one excavation. In certain instances there was evidently formerly an ornamentation on some of these which had been obliterated; on others no sign of decoration could be discovered. The polished undecorated ware was ordinarily red, but there were likewise specimens of white and black undecorated ware.

DECORATED POLISHED WARE

RED AND BROWN WARE

Red and brown ware is distinctively characteristic of the ruins found along the Little Colorado, and of those south of this river to the border of Mexico. The decorations on this ware (plate XXVI) found along the Colorado river are much more complicated than those of southern Arizona, where plain red ware is almost universal. In both regions the color is no doubt due to the composition of the available clay, and to changes in firing. Bricks made from this clay at the

^aA large number of these vessels were found in the more southern ruins excavated in 1897, especially that near Snowflake, Arizona, where the largest collections were made that year. As this pottery will be discussed at length in the report for that year, it is barely mentioned in this section of the memoir.

present time have much the same texture and color as the ancient vessels—probably for the same reason.

YELLOW WARE

The fine yellow ware which is characteristic of the old ruins near the inhabited Hopi pueblos is not found in the Little Colorado ruins. There are many pieces (plates XXVII, XXVIII) which approach it in color, but for the most part they lack that fine gloss which distinguishes ceramic objects of Sikyatki, Old Shumopovi, and other Hopi ruins. While this difference may be in part ascribed to the chemical components of the clay, the skill of the potter must also be given due credit. While yellow ware was sparingly made in the southern pueblos, it reached its highest development in the villages which are nearest the modern Hopi.

In the decline of pottery making the fine old yellow ware has greatly deteriorated, and, although clever Hano artists copy it with some success, they have never been able to equal the finest specimens which the author has dug out of Sikyatki sand hills.

BLACK WARE

The Santa Clara pueblo Indians of New Mexico, as is well known, make a characteristic black ware. The author has thus far failed to find any specimens of this ware in Tnsayan, but in the ruins of Homolobi, Cheylon, and Chaves pass several food basins were found the interiors of which were blackened and apparently glazed in the same manner as is the Santa Clara pottery. In no instance, however, was the external surface thus blackened. Some of these food basins with black interior were of coiled ware; others were of smooth ware, but all were destitute of other decoration.

BLACK AND WHITE WARE

The so-called black and white ware is found almost universally in cliff houses throughout the Southwest, and has been thought to be characteristic of this kind of dwelling. In his excavations at Sikyatki, however, the author found several pieces, and the same kind was also taken from the older quarter of the ruin of Awatobi. Several beautiful pieces of black and white ware, with decorations which are identical with those of pottery from Colorado cliff houses, were taken from the burial places at Old Shumopovi. In the Homolobi and Cheylon ruins a number of most interesting bowls, vases, and dippers of this kind of ware (plate XX) were exhumed, and the same style of ware occurred at Chaves pass. It appears, therefore, that black and white ware is not uncommon in ruins of pueblos in the plains as well as in cliff houses, which is but one of many evidences of the similarities in culture of the peoples inhabiting these two kinds of ancient dwellings. The author was at one time disposed to regard these pieces as heirlooms, but the considerable number of specimens

found would seem to indicate contemporary habitation of the villages and cliff houses from which they have been taken.

No specimen of the black and white ware in the collection is decorated with designs representing human beings or animals, and even pictures of birds, so abundant on other colored ware, are wanting. The designs are purely geometrical figures, which are ordinarily regarded as the most ancient style of ornamentation. These geometrical figures, however, are very complicated—as a rule far superior to similar decorations on other colored ware. They duplicate for the most part the patterns on black and white ware from the cliff dwellings of southern Colorado and western New Mexico, the headwaters of the Salado and Gila rivers.

Among the specimens of black and white ware there are several dippers made of a very fine paste almost as compactly hardened as rock. All of these, with one exception, were broken, and the single unbroken specimen, one of the most beautiful in the whole collection, disappeared from the table in the National Museum after it had been seen and admired by many visitors. The author much regrets the loss of this beautiful object, especially after it had been brought safely to the National Museum.

While black and white ware is abundant in the cliff houses of the San Juan, it is relatively as abundant in the houses of the plains in some parts of New Mexico, as may be seen in the great collections made in recent times in the Tularosa valley.

RED AND BLACK WARE

A majority of the ceramic objects from the three ruins investigated in 1896 were red with black decorations. This variety was so abundant that it may well be styled the characteristic pottery of the Little Colorado and its tributaries. Black and red ware is found in the ruins near the Zuñi river, an affluent of the Little Colorado, and is also found in ruins widely distant from the Colorado, but we are justified in regarding this combination of colors as distinctive of the Colorado drainage area. Some of the best specimens of the glazed ware well represented in the collections of 1896 are of these two colors, the black designs being almost always glazed.

The red color is due to the clay, since bricks made at Winslow have practically the same color. The many specimens of red and black pottery with marginal lines in white on the black form a transition from this variety into the next, in which, however, the white is more prominent.

RED, BLACK, AND WHITE WARE

The type of ancient pottery included in the above designation (plates XXI, XXII) is, as far as research has thus far gone, peculiar to the Little Colorado ruins. No specimen of it has yet been figured (1896), and there are no examples of it in the different museums with which the author is familiar.

The three distinctive colors are red, black, and white—the latter forming not simply bordering lines in the designs, but being used as a slip to cover a considerable surface of the object decorated. While specimens of this kind of pottery do not occur in ruins near the inhabited Hopi pueblos, it is probable that the modern use of a white slip by potters in those villages is a lineal descendant of the ancient method of decoration.^a

This colored ware is not found in ruins south of the Mogollon mountains, but is confined to the Little Colorado river and its southern tributaries.

WHITE AND GREEN WARE

A limited number of pottery objects of light color, with dark-green glazed geometrical figures, were found in the Little Colorado ruins (see plate XLII*b*). This kind of ware appears to be rare in the Hopi country, ancient and modern, but whether it is indigenous or intrusive the author has been unable to discover.

CLASSIFICATION BY FORM

The various forms of pottery are determined largely by the uses for which it is intended. They may be classified as follows: 1, food bowls; 2, vases; 3, jars; 4, ladles; 5, mugs or dippers; 6, canteens; 7, enps; 8, animal-shaped vessels; 9, slipper-shaped vessels.

FOOD BOWLS

The food basins (plates XXIII–XXIX) exceed in number all other forms of pottery, and as a rule have the same shapes as those from Sikyatki and Awatobi, described in the report on those ruins.^b The basins are ornamented on the interior with symbolic designs, in which geometrical figures predominate.

There is a much larger proportion of designs encircling the exterior of the ware in the Little Colorado pottery than in that of Sikyatki, and curved lines are also more common. Some of the food bowls made of red ware are very large, but from their fragile nature and size the majority of these were broken.

VASES AND JARS

The collection of vases was very large, but the pieces are, as a rule, smaller than those previously described from Sikyatki. Some of the forms of these vases may be seen in the accompanying plates (XXX–XXXV). The majority are globular, with a slight neck, but there are several in which the neck is elongated.

^a The use of a white slip is a marked feature of the pottery now manufactured at the East mesa of Tusayan. This appears to have been introduced after the fall of Sikyatki, for the fine yellow ware of this pueblo shows no white superficial covering.

^b Seventeenth Annual Report of the Bureau of American Ethnology, 1898, pt. 2.

The designs on vases are usually geometrical; animal and human figures are wanting. Some of these vases are very small, having evidently been used for pigments or condiments. The lip is sometimes decorated with parallel marks, but with one exception the interior is destitute of ornamentation. A single specimen had an



FIG. 12. Ladle with divided handle, from Cheylon (number 157051).

indented or concave base, to secure stability, but in the majority the base is rounded.

The distinction between vases and jars is more or less arbitrary, the latter having, as a rule, a smaller orifice.

LADLES

Many ladles were found in 1896, the general forms of which were in no respect peculiar. The most striking variations are in the form of the handles. They are usually decorated on the interiors, and generally with geometrical patterns.



FIG. 13. Ladle with figure on handle, from Cheylon (number 157306).

Figure 12 shows a ladle with a double handle—a rare form. Figure 13 is a ladle with its handle decorated with a human figure. The evidences of wear on the edge of this ladle are pronounced, showing that it was probably used in dipping food from bowls or vases. In modern times gourd ladles are generally used for drinking purposes.

Many ladle handles broken from their bowls occur in all the excavations, and from the appearance of the broken end it is evident that the handle was made separate from the bowl and was later joined to it. A conical projection from the side of the bowl was inserted into a cavity of the handle, which is sometimes hollow throughout, and was then luted in place before firing. Several ladle handles were perforated, and in one specimen there were small pebbles which rattled when the ladle was shaken.

The extremity of the ladle handle was at times fashioned into a rude image, recalling the clown priests' heads so common on modern clay ladles. The ladle with hollow handle opening at one end into the bowl, which is so commonly made in modern times by the Pueblo potters,^a has not yet been found in the ancient habitations of Arizona.

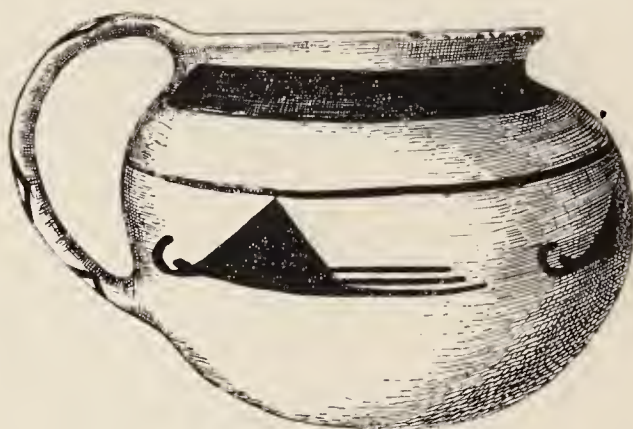


FIG. 14. Cup with bird designs.

CANTEENS

The canteens by means of which the ancients carried drinking water were shaped somewhat like the modern canteen, but were more flattened, and generally decorated. While canteens of this shape from old Tusayan ruins are known, they have not yet been excavated from any of the Little Colorado ruins.

The second kind of canteen, of which several were found, has a very different form and probably a different use. While the former was generally borne on the back, the second was carried in the hand. It has an oval or globular form, with a handle which is hollow, having an opening midway in its length. It is possible that this form of canteen (plate XXXVI *b*) was used to carry water for ceremonial purposes from a spring to the ceremonial chambers, or possibly from the houses to the fields. These canteens are of small capacity, and are generally ornamented exteriorly with complicated designs.

^aThese forms of drinking ladles, made of clay or gourds, are used in the following way: The water is dipped up in the bowl and the end of the handle is put in the mouth. A proper slant to the bowl allows the liquid to pass through the handle into the mouth. The ancient ladles were not used in this way, but were used as dippers are to-day.

CUPS

The antiquity of the cup form of household utensil has been questioned, but from these excavations there seems no reason to doubt that this form was made in prehistoric times. Numerous specimens (figures 14-19) were found at Homolobi, Cheylon, and Chaves pass, and the material of which they are made differs in no respect from that of other vessels.

A very fine specimen of coiled ware (figure 15) had a handle made of two coils of clay artistically twisted together. There were a few specimens of cups with flat bottoms, but the majority were in



FIG. 15. Dipper from Homolobi (number 156891).



FIG. 16. Mug from Homolobi (number 156891).

the form of small vases with rounded base. The decoration of the cups was external; the interior was smooth, without figures. Geometrical figures predominated in ornamentation. Several specimens bore evidences of considerable use, the rims being in some cases much worn. One of the best of these cups, with handle made of two coils, is shown in figure 16.

The bowl-shaped cup shown in figure 17 is made of rough

coiled ware decorated on the exterior, and has a glossy, black inner surface. The form of the handle is exceptional, and is not duplicated in the collection.



FIG. 17. Cup, rough ware, decorated, from Cheylon (number 157095).

A number of vase-form vessels with handles connect the true mugs with vases. The general form of these is the same, but the position

of the handles varies. In figure 18 the handle extends from the lip of the vessel to near the equator, while in figure 19 it is smaller, and placed just below the neck of the vase. In figure 17 the handle is confined to the equatorial region.



FIG. 18. Mug.

There were several specimens of a mug form in which the body is trifid. These forms were probably used for pigments or condiments, and were of rough ware, or were polished and sparingly decorated.

The external decoration of these cups varies in character as widely as does their form; but in plate XXXIV the reader will find some of the designs, which are practically the same as those on the inside of certain food bowls from the same ruins.



FIG. 19. Mug from Cheylon (number 157294).

ANIMAL FORMS

Pottery objects in the forms of birds, though common among the ceramic productions of certain modern pueblos, are rarely found in ancient ruins. The excavations made in 1896 brought several specimens of these to light, one of the best of which was from Cheylon (figure 20). In this specimen we have a well-made head recalling that of a duck, and three knobs representing the tail and wings. Interesting in connection with this specimen is the presence of triangular designs with terraced figures painted on the sides.

It may be supposed that the vase (figure 21), with four knobs

arranged at equal intervals about the equator, is a highly conventionalized bird vase in which the head, wings, and tail are represented by knobs or rounded elevations. Figure 20 has on one of the knobs a head with goggle eyes and teeth, recalling a bird figure which is not



FIG. 20. Duck-shaped vessel from Cheylon (number 157018).

an anomalous form in southwestern pictography. In view of the identification of the terraced figures with wings, the decoration on the equator of this bird-effigy vase are highly suggestive.

A second bird-form vase is shown in figure 22, in which the vessel



FIG. 21. Jar with four knobs, from Homolobi (number 156354).

is elongated and has a round head projecting at one end, with a beak like that of a parrot. The eyes project from the head, and there is an opening for a mouth. On the side of the body there are parallel lines representing feathers painted in red and black. The tail is broken.

A third kind of bird-form vase is more globular in shape, with head appended to the rim. The wings and tail are represented by figures drawn on each side of this vase, and eyes are painted on the sides of the head. The strange raised S-shaped bodies on the sides of this vase are of unknown meaning, but they suggest legs. A view of



FIG. 22. Bird-shaped vessel from Cheylon (number 157909).

this vase from one side is shown in figure 23. The length of the appendages represented in relief on this vessel suggests some long-legged wading bird, possibly a crane.

Plate XXXVI *a* shows a conventional effigy bowl in which the rim is modified to represent the head, tail, and wings of a bird.



FIG. 23. Bird-snake vase from Cheylon (number 157311).

The preceding forms, representing all effigy objects which were found in the excavations, naturally lead to a consideration of the great difference in the ceramic technic of northern and southern Arizona and New Mexico. As we go south there is an ever-increasing tendency to combine relief with pictorial decoration; effigy vases, including those in the form of men and animals, increase in number, until

in Mexico relief decoration becomes the essential feature. In its earliest development the head is raised in relief, while arms and legs are indicated by ridges, as in a figure from the Nantaeks, considered later in this article. In the Gila valley, clay reliefs of the human figure on a jar or vase were attempted—a thing unknown in ancient Tusayan.

SLIPPER-SHAPED VESSELS

Several rough-ware jars in the form of slippers were found in the ruins excavated in 1896. From the fact that many of these were blackened with soot, it is conjectured that they were formerly used for cooking vessels, and it is probable that they were made in that peculiar form in order that they might be used like Dutch ovens and coals of fire might more readily be heaped over them. Many of these slipper-shaped jars had one or more handles placed on the necks or prolongations of the rims.

These jars were always made of rough ware, and were never painted, as is the case with similarly formed vessels from the Gila river and its northern tributaries. They vary in length from a few inches to a foot or a foot and a half.

DECORATIVE DESIGNS

GENERAL CHARACTER

The great value of collections of pottery from the Southwest, especially from the ruins in Arizona, is to be found in the symbolic decoration and its interpretation. The collections in 1896 were especially instructive on account of the new localities from which they were made and of the new symbols depicted. As is universally the case, avian figures are the most common and the most elaborately conventionalized. There are one or two instructive reptilian designs.

A study of the decoration on the pottery of the Homolobi, Cheylon, and Chaves pass ruins shows that the proportion of geometrical to animal designs is much larger than at the Sikyatki or Shumopovi. In the few instances where animals and human beings are depicted the execution of the designs is ruder. This preponderance of geometrical over animal figures recalls conditions characteristic of white and black ware ornamentation. The predominance of animal pictographs on pueblo pottery in ancient times appears especially characteristic of Tusayan.

The most novel results obtained from a study of the collections of pottery were contributions to a knowledge of ancient pictography.^a

Even a superficial comparison of the pictography of the Little Colorado pottery with that of the Sikyatki ware shows how inferior the

^a The majority of forms of ancient Tusayan ware are well known to archeologists through the Keam collection, some of the more striking specimens of which have been figured by Mr Holmes in previous reports of the Bureau of Ethnology.

former is to the latter. A deeper study confirms this conclusion. Nowhere in the pueblo region has the ceramic art reached the high position it attained in Tusayan in prehistoric times. This development may be due in part to the character of the material used, but it is mainly owing to the artistic instinct of the ancient Hopis.

In both the character of the paleography and the texture the ware of the Little Colorado ruins is more like Zuñi than Hopi work. The ancient pueblos on the Zuñi river, a tributary of the Little Colorado, closely resemble those about Winslow and at the mouth of Cheylon fork, but their pottery is as a rule inferior.

HUMAN FIGURES

Pictures of human beings were very rarely found in the excavations at the Little Colorado ruins. This rarity conforms with results from other ruins, described by other archeologists, so that the author suspects that delineations of the human figure, of which several were found at Sikyatki, indicate a late stage in the evolution of pottery decoration in ancient pueblos. The drawings of human beings which have been found are for the most part of the rudest possible character, showing no elaboration such as would be expected if they had been used many generations for decoration.

But a single complete figure of a human being on pottery was exhumed in 1896, and that was on the handle of a ladle from Cheylon. The specimen (figure 13) represents a woman with left arm lifted high above the head. It has been identified as the figure of a woman from the presence of the characteristic coiffure of



FIG. 24. Footprints on inside of a vase from Homolobi (number 156690).

maidens, to which the author has called attention in his account of designs from Sikyatki. The end of the handle of this ladle turns at right angles, and suggests an explanation for numerous clay objects of like shape which have been found elsewhere.

Among human figures, however, may be mentioned the unique ornamentation on the inside of the vase from Homolobi (see figure 24), where we have on one edge the representation of the head, neck, and extended arms, one of which carries a rattle, the other a spear. A line of footprints extends across the inner surface of this vase, and the body and legs are represented on the opposite side. It will be noticed that the portions of the human figure represented at the two ends of the line of footprints are complementary; the head and arms appear at the bottom, the body and legs at the top. It would seem that



FIG. 25. Quadruped figure on food bowl from Chaves pass (number 157570).

the artist intended to represent the tracks of a seated figure at the bottom of the line of footprints, the marks being paired at that point.

The inside of the food bowl shown in plate XXVII *b* is decorated with a human face, in which eyes and mouth are represented. Above the head is a crescentic figure in white, resembling the moon, into the concave side of which project four pairs of tubercles from the top of the head. This is one of the few specimens from Homolobi in which a human face is depicted.

QUADRUPED FIGURES

There were a few pictographs of four-legged animals, two of which are identified as mammalian forms. Mythical lizards and batrachians are represented, but no complete picture of any reptile was found which could be identified.

One of the most interesting pictures of mammalian animals occurs on a broken food basin from Chaves pass. This specimen (figure 25) represents an animal with long claws, a tail reaching above the body to the head, two triangular ears, and an arrow-shaped tongue. It is one of the few figures in which the intestinal tract is represented, and it has two eyes on one side of the head.

The design on the food bowl shown in figure 26 represents a four-footed animal which was identified by one of the Hopis as a bison, and the hump on the back certainly suggests this animal. This figure, like the preceding, has two eyes on one side of the head, but, unlike it, has the four legs all depicted in the same plane. The



FIG. 26. Quadruped figure on food bowl from Cheylon (number 157102).

geometrical figures below this quadruped are of unknown meaning. The bowl is of red ware, with black and white decoration, and is one of the finest of this kind from the Cheylon ruin.

As a rule, vases are ornamented on the equator, and it rarely happens that any design is found on the bottom. The specimen shown in figure 27, however, has a design in that region resembling a paw of some animal, possibly a bear or badger. The form and character of ware which distinguish this specimen are likewise highly instructive.

BIRD FIGURES

The majority of the animal figures on specimens from the three southern ruins represented birds, many of which were highly conventionalized. While there were many objects of pottery adorned with feathers, this style of decoration was not as common or as varied as at Shumopovi, Sikyatki, Awatobi, or other ruins on the Hopi reservation. The conventional forms of feathers so common on the decorated pottery of Sikyatki are not found in the designs ornamenting the pottery of the Little Colorado ruins, but seem to be confined to the pueblos in the present Hopi reservation. Thus, not a single specimen of the conventional feather figured on the "butterfly vase" shown in plate CXXV of the Seventeenth Annual Report of the Bureau of American Ethnology, part 2 (and also plate XL, Smithsonian Report, 1895), was found on any vessel from Homolobi, Cheylon, or Chaves pass.^a



FIG. 27. Vase with bear's paw design (number 157187).

The peculiar symbol of the breath feather (Seventeenth Annual Report of the Bureau of American Ethnology, plates CXXXVIII *b* and CXLI *c*, *d*) also appears to be limited to objects from ruins near the inhabited Hopi pueblos. On none of the many figures of birds shown in the Little Colorado pottery have we any such complicated symbols appended to wing or tail. The figures of birds from Shumopovi resemble those from Sikyatki, but no pottery from a Little Colorado ruin is found decorated with the conventional figure of the feather so constant in the ancient ruins above mentioned.

It will be noticed in the figures of birds from Homolobi and Cheylon that the posterior end of the body has a triangular form which apparently represents the tail. At one side of this triangular figure are many short parallel lines, evidently intended to represent the tips of the tail feathers, well brought out in the bird figures.

The design shown in figure 28 represents two birds, above which are emblematic rain-cloud symbols with parallel lines representing

^aConsult The Feather Symbol in Ancient Hopi Designs, *American Anthropologist*, v. 11, n. 1, January, 1898.

falling rain. The figures of these two birds are decidedly Egyptian in form. Their beaks are turned in the same direction, and both have two eyes on one side of the head. The wings are of special interest to students of Hopi symbolism, for they are represented by triangles—which is often the case in ancient Tusayan pictures of mythic birds. This bowl, found at Chevlon, is of the red ware characteristic of the Little Colorado ruins. The triangles at the lower ends of the bird figures are tails, and the short parallel knobs represent the tips of the tail feathers. This is important to



FIG. 28. Mythic bird figures and rain-cloud symbols on food bowl from Chevlon (number 157221).

remember in the study of symbolism, for we sometimes find the same symbols depicted alone on a vase (see figure 36).

No specimen from the Little Colorado ruins has a diametrical line representing a "sky band" to which hangs the conventional figure of a bird—a design so common in the best Sikyatki ware. A good example of this ornamentation is shown in a food bowl from Shumopovi (see figure 73, page 117). We miss also the star design and the trifid cross so commonly associated in Tusayan ware with the bird symbols.

Attention is called to the form of the tail of the two birds in figure 28 and to the triangular designs called feathers seen in the same figure. It seems not improbable that in the conventionalization of bird figures the design representing a bird may be reduced to two triangles, making an hourglass-shaped figure. Suppose, for instance, wings and head be omitted in figure 28, the tail and body would then be two triangles joined at the apices.

The design on a vase from Homolobi shown in figure 29 represents four birds, each one of which



FIG. 29. Vase with four bird figures, from Homolobi (number 156676).



FIG. 30. Mythic bird figure on food bowl from Chaves pass (number 157563).

has a crested head of feathers and widespread wings of triangular form. The body is continued into two triangular extensions, as is

the case in so many bird figures, and the tail feathers are indicated by short, stumpy, parallel lines attached to one side of a triangle. The middle of the body is represented by a lozenge-shaped figure, in the center of which is a dot. Trifid triangular designs alternate with the bird figures, and the bird figures are arranged as though moving in a sinistral circuit.

The figure of a bird on a food bowl from Chaves pass (figure 30) is characteristic. This represents a toothed bird, a conception often repeated in the ancient pueblo pictography. Both eyes are on one side of the head, which is rounded posteriorly and prolonged into an upper and lower dentate beak. The triangular wings are terraced or



FIG. 31. Bird design on food bowl from Homolobi (number 156603).

notched on one edge, and the tail is triangular, with short, white appendages representing feathers. Although a simple figure, this is one of the most instructive bird designs in the collection. The conception of a toothed bird is certainly remarkable, but we find it still current in the Walpi ritual, where it is personated, as in the so-called Natackas which appear in the Powamû, or Bean-planting, a ceremony when the fields are prepared for planting.

The figure of a bird represented on a food bowl from Homolobi shown in figure 31 is different from any elsewhere collected. Par-

ticularly interesting is the drawing of the wing and the shape of the body, which is bordered by small triangles. Both eyes are represented on one side of the head, and the tail feathers, four in number, are represented in a vertical plane.

The food bowl shown in figure 32, from Homolobi, is decorated on the interior with a design representing the head, neck, and legs of a mythic bird. There are two eyes on one side of the head, and the tongue has a tip like an arrowhead. The wings bear triangular appendages representing feathers. The talons recall those of the



FIG. 32. Bird figure on food bowl from Homolobi (number 156870).

“unknown reptile” from Sikyatki, figured in plate LXII of a preliminary report on that ruin.^a We have in this figure a representation of both wings in the same plane, a constant feature in Pueblo drawing. There is also a view of a body cavity, which is not rare in modern Pueblo figures of animals.

One of the most striking pictures of birds is that depicted on the interior of the food bowl from Cheylon, shown in figure 33. The

^a Annual Report of the Smithsonian Institution for 1895.

most remarkable of all the appendages are those on the tail, the meaning of which the author can not interpret. It was sometimes customary to equip a bird figure with a long snout in which were teeth, and this conception persists among the Hopis, as has been noted above. It is interesting to note that in this figure, as in the majority of bird figures from the Little Colorado ruins, the tail is represented by a triangle, and the tail feathers or their tips by three parallel lines.

The interior of the food bowl shown in figure 34 is decorated with a bird design which exhibits some of the notable violations of perspective common in ancient Tusayan art. We here find wings, legs,



FIG. 33. Mythic bird figure on food bowl from Cheylon (number 157264).

and tail feathers shown on the same plane, notwithstanding that a side view was intended.

The indication of the claws by crescents in this figure is interesting. The same method is adopted in another bird figure, in which there are in each foot two short parallel lines. This method is likewise used in one of the designs from Sikyatki which was identified as representing an unknown reptile.^a There is some doubt whether this figure represents a lizard or a bird, for a considerable part of the body is posterior to the appendages. If we consider the posterior

^a Seventeenth Annual Report Bureau of American Ethnology, pt. 2, 1898, figure 269.

appendages as a pair of legs, they bend the wrong way, unless the whole portion from the angle to the claws is regarded as foot. This is not an avian feature, but the presence of semicircles and triangles on the body is characteristic of bird symbolism.

In studying the different figures of reptiles from ancient pottery the author finds no other in which the feet have this form—which occurs in undoubted bird figures from Homolobi and Cheylon. It might therefore be concluded that the Sikyatki figure was wrongly identified and should be called a bird. There are, however, almost fatal objections to this identification. The most striking of these is the



FIG. 34. Bird figure on food bowl from Cheylon (number 157084).

elongated form of the body. The anterior appendage, which is identified as a leg, can hardly be homologized with a wing, although it must be confessed that the parallel lines may be feathers.

The reexamination of the figure in the light shed on the subject by the bird figures from Homolobi reveals that it has both bird and reptilian features, and that the former predominate.

Two raptorial birds are painted on the food bowl shown in figure 35, on opposite sides of terraced figures which recall cloud symbols. The birds are shown in profile, with both eyes on one side of the head

and tail feathers thrown out of perspective. Wings are not represented, and the body is covered with cross-hatched lines. In a bowl from Shumopovi we likewise find two birds represented from a different point of view, and also terraced figures which have been interpreted as rain-cloud symbols.

The triangular designs on the vase shown in figure 36 are interpreted as feathers, or rather as the tails of birds with appended feathers. The reason for the interpretation is to be found in the study of the bodies of birds as represented in the Little Colorado pottery. The author has elsewhere shown several instances in Sikyatki



FIG. 35. Food bowl with bird designs.

pottery where symbolic feathers are represented as tied about the neck of small vases, and even at the present day certain gourds in which sacred water is brought from springs in kiva ceremonials have feathers tied in this position. The triangle, as a feather symbol, is still found in certain altar pictures—as the snake-lightning designs in sand of the Antelope altars. It is interesting to notice that these feather symbols have parallel white lines on one side.

The only other symbol with which these triangular figures on the Homolobi vase could be identified are triangular rain clouds, the short parallel lines representing falling rain. These symbols would

also be appropriate on this small vase, but there is more likelihood that the triangles in this instance are feather symbols.

INSECT FIGURES

In an account of the insects used in pottery decoration at Sikyatki attention was called to the use of the moth or butterfly and the dragon fly. Both of these forms occur on pottery from the ruins along the Little Colorado, and their symbolism appears to be the same in all the ruins in Arizona thus far studied. The butterfly is commonly indicated by a triangular figure, which often becomes highly conventionalized, as in plate XXV *b*.



FIG. 36. Vase with bird symbols, from Homolobi (number 153880).

ARACHNID FIGURES

The spider plays an important part in Pueblo mythology, and the so-called Spider woman is often mentioned in connection with the Sun and the war god.

The design on the food bowl from Homolobi shown in figure 37 represents a spider, and a figure of the sun on the outside of this bowl recalls the legend of the Spider woman who married the Sun. The association of these two symbols on an ancient vessel shows the antiquity of this well-known legend.

There are appended to the cephalothorax of this animal four pairs of legs, which number distinguishes arachnids from insects; there are two jaws at the anterior and a feather at the posterior extremity.

The figure of the sun on the exterior of this food bowl is a simple ring surrounding a white zone, in the interior of which is a black spot. The four peripherally placed sets of three parallel lines are supposed to represent eagle feathers, a constant feature in sun emblems, or red horsehair, symbolizing the rays of the sun. The sand picture of the sun in the Powalawû, a ceremony preceding the

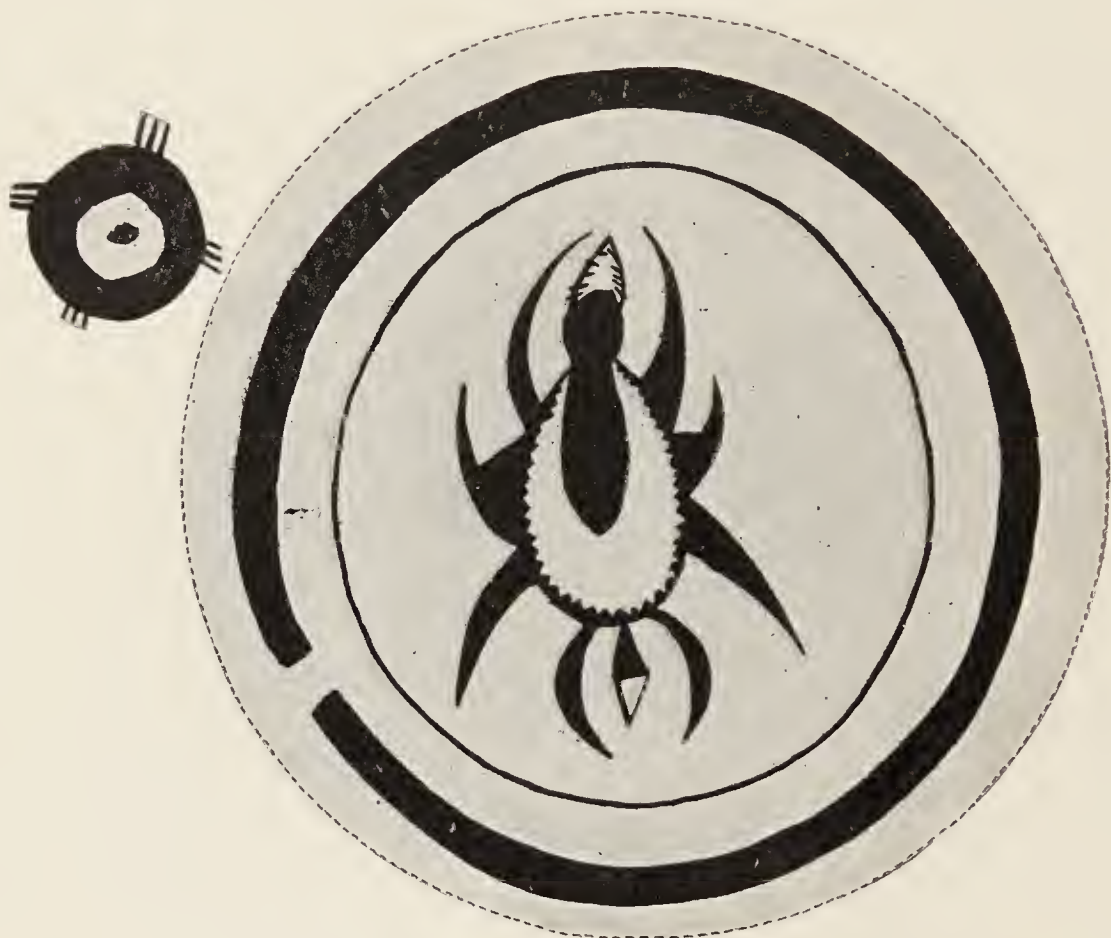


FIG. 37. Spider and sun emblem on food bowl from Homolobi (number 156888).

Powamû in February, as made in Oraibi, is identical with the design on this food basin.

Kokyan wûqti, or as she is generally called, Kokyan maua, the Spider maid, was the parthenogenetic mother or grandmother of the twin war gods, Pûûkoñ hoyá and Palûña hoyá. As she was supposed to have been impregnated by a sun's ray or a drop of water falling upon her, the sun is therefore called the father of the twins.

In various current legends the Spider woman is represented as one who can change her form at will, acting as mentor to the hero Pûûkoñ,

generally perching on his ear, and whispering her promptings from that position. She assumes several rôles and is designated by many attributal names. She is sometimes called "creator," but is an earth goddess or mother rather than an artificer of nature.

GEOMETRICAL DESIGNS

The wealth of geometrical ornamentation (plates XXVIII, XXIX) in Pueblo pottery decoration has attracted the attention of many stu-



FIG. 38. Three lines of life. Design on food bowl from Cheylon (number 156138)

dents, and a large literature has accumulated on that subject. This form of decoration is the simplest in motive, the most widely spread over the pueblo area, and also probably the most ancient. Its relations to decoration of textile art products are pointed out by several writers, and there are many evidences of the evolution of complicated geometrical figures from simple forms. There are also evidences of their origin by conventionalization of more elaborate patterns through symbolism.

The design on the food basin shown in figure 38 is unique and highly instructive in one important feature. Encircling bands or lines on specimens of ancient pottery are ordinarily broken at one point, as

can readily be seen by an examination of figures in the report on Sikyatki pottery, as well as in the present memoir. The design before us has three breaks in these encircling bands. The break in the interior band is complicated by the addition of well-known terraced figures. By modification in form and by the interlocking of these appendages we pass easily to some of the most complicated geometrical patterns of Pueblo pottery.

A modification of the broken line about a vase appears in the specimen shown in plate XXXVIc. In this instance we find the band continued into two narrow extensions, which interlock but do not



FIG. 39. Geometrical designs on a food bowl from Chaves pass (number 157539).

join. The figure which is thus formed is a common one in geometrical ornamentation, as may be seen by an examination of the many beautiful pieces of pottery obtained from the ruins in all parts of Arizona.

Not less instructive than the last-mentioned in a study of geometrical ornamentation is the design in figure 39. The spiral figures on two of the bands show a modification of the broken lines which are characteristic, and the S-shaped ornaments on one of the other bands are common on ancient pueblo ware.

A combination of oblique lines and fret, shown in figure 40, is the most unusual design in the collections which it has been the author's fortune thus far to examine. The same design is worked in a basket from the same ruin (figure 63).

The design figured on the interior of the food bowl shown in figure 41 is unique, reminding one of a swastika with arms split into two parts. We recognize in it the familiar



FIG. 40. Broken fret on food bowl from Cheylon (number 157895).



FIG. 41. Food bowl with geometrical patterns (number 156427).

triangle and crook, but the long scythe-like projections on the periphery of the design are rarely found in ancient pottery decoration.

The decoration of another food bowl from Homolobi is likewise unique, but it is formed of familiar decorative designs arranged in an irregular manner.

ORNAMENTS

MOSAICS

The ancient pueblo peoples of Arizona were adepts in making mosaic, some examples of which rival in excellence the work of a similar kind in old Mexico. The author's explorations in 1896 revealed different kinds of this craft, several of which are unique. The southernmost ruin, that in Chaves pass, yielded the most beautiful specimen, but those found at Cheylon were almost as fine, and the variety was greater.

In the course of excavation there were found in the soil, near a buried body, a large number of accurately squared turquoises which were so small that they could hardly have served for ornament alone, and with them were found worked shells covered with a tenacious pitch. In one of these collections there are several larger fragments, evidently turquoise ear pendants. Later excavations explained the character of these turquoises, for they were found to be duplicated in specimens of fine mosaic ware.



FIG. 42. Mosaic gorget from Chaves pass (number 157850). Length about 2 inches.

It is well known that Hopi women at the present day wear ear pendants made of square wooden plates, upon which are cemented rude mosaics of turquoise. The modern work of this kind is comparatively coarse, and evidently is made of old turquoises, some of which are perforated and were formerly used as beads. The turquoise stones employed are not accurately fitted, and the black gum in which they are embedded shows between the stones. The ancient work (plate XLIV) is much finer and more beautiful than the modern.

Specimen 159850 is a turquoise mosaic set on wood, but it was so broken that it was impossible to tell what its form was.

The specimen shown in figure 42 is an elongated gorget of wood with shell and turquoise incrustation; it was found at the Cheylon ruin, and is one of the most beautiful of prehistoric mosaics. Figure 43 shows a pear-shaped pendant made of bone with turquoise mosaic on one side and incised chevrons on the opposite. It is perforated at the blunter end as though for suspension. The specimen was taken from the Cheylon ruin, and is unique. The collection contains also a number of fragments of turquoise and other stone mosaics, and of catlinite and turquoise embedded in gum on wood. These were from the Cheylon ruin. Many other square turquoises, evidently formerly parts of a mosaic, were collected at the same ruin.

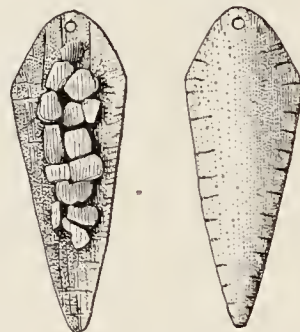


FIG. 43. Bone ear pendants from Cheylon (number 157852). Length about 2 inches.

The specimen shown in figure 43 was found near the mastoid process of the skull of a woman. It was evidently an ear pendant, one attached to the ear by a string. Two other specimens of bone incrustated with stone mosaic were found at Cheylon.

One of the most beautiful examples of mosaic was a worked shell of *Pectunculus giganteus* covered with turquoise stones embedded in pitch. It was found on the sternum of a skeleton from Chaves pass, and was buried several feet below the surface of the ground. Plate XLIV shows two views of this unique and precious specimen, one from above and one from the umbo of the shell. In the former

a median rectangular fragment of red jasper is shown, and in the latter appears the hole by which the ornament was formerly suspended. The latter likewise shows legs, suggesting a frog, turtle, or toad. The arrangement of the lines of turquoise on the opposite rim, obscurely seen in the upper view, has been regarded as representing the hind legs of the same animal. The technic of this mosaic recalls work of the same general character on dirk handles and masks from Mexico.

Several additional specimens of similar stone mosaic on shells were found, but these were much broken and impossible of restoration. The mosaic frog was broken when found, but the anterior end was entire and still clinging to the shell when dug from the ground.

A summary of the specimens of mosaic collected is given with their catalogue numbers in the following list:

Number	Article
(1740)	Squared fragments of turquoise formerly incrustated on shell
157849	Square lignite pendant for ear, with turquoise in each corner and middle
159850	Pendant of wood incrustated with stones
157852	Pyriiform ear pendant of bone, with turquoise incrustation
158068	Fragments of a mosaic of turquoise and other stones
157848	Fragments of stone mosaic on wood
157932	Fragments of stone mosaic on wood
157851	Mosaic frog, toad, or turtle

LIGNITE ORNAMENTS

One of the common uses of lignite was that of ornament. The specimen represented in figure 44 is a square ear pendant, taken from near the mastoid process of a human skull in the Cheylon cemetery. It is made of lignite, nicely polished and accurately squared. In each corner and in the middle on one face irregular turquoises are set in depressions, while on the obverse, near the middle, there is an eyelet in the substance of the pendant. The button-shaped gorget shown in figure 45, unfortunately broken, was flat on one side, and convex on the opposite, which was smoothly polished. The striae across the flat side suggest the polishing stone, and the perforations point to suspension by a string or thong. This is one of the best formed lignite buttons in the collection, but ruder forms have been taken from other ruins.

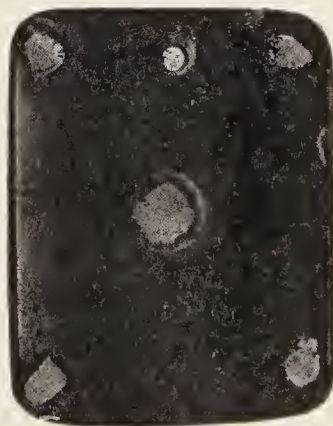


FIG. 44. Lignite ear pendant from Cheylon (number 157849). Natural size.

Unworked fragments of lignite are rare, and the material appears to have been brought to Cheylon from some distance, although it is common in the rocks near the modern Hopi villages.

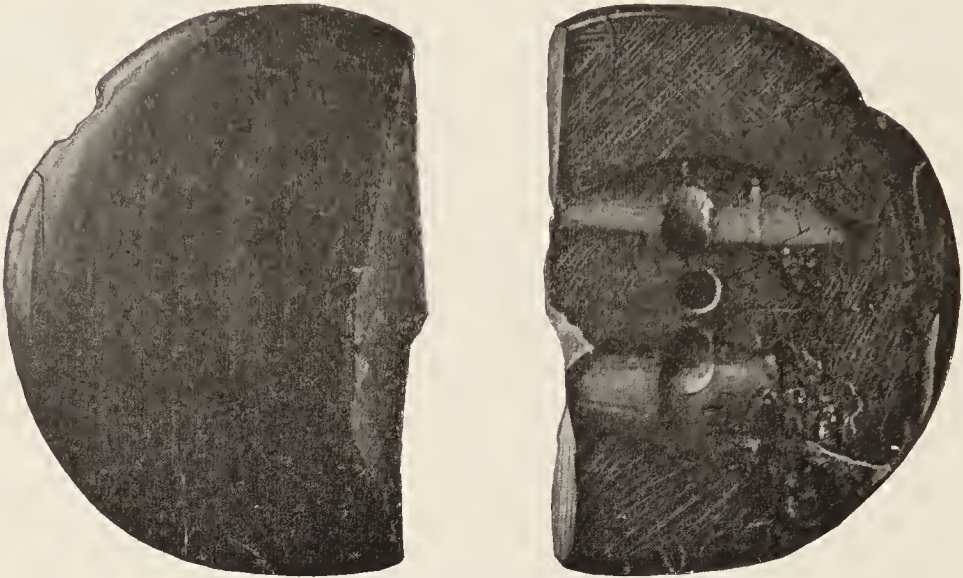


FIG. 45. Lignite gorget. Slightly reduced.

SHELL ORNAMENTS

The collections made in the summer of 1896 were particularly rich in ornaments made from marine shells. The largest number of these were found in the ruins at Cheylon and Chaves pass, although a considerable number of specimens were collected from the ruins of the Homolobi group.

The shells used in making these ornaments belong to the Pacific coast fauna, and no doubt came through barter to the people who once inhabited the towns of the Little Colorado, for it is well known that there was a considerable trade in early times in these shells, and long trips were taken by the Pueblo Indians for trade purposes.

The intercourse of northern and southern peoples of Arizona through trading expeditions continued to quite recent times, but judging from the number of specimens which were found in the ruins it must have been considerably greater in prehistoric times than it is at present. In fact, much of the decline in this traffic is probably to be traced to the modification of the southern Arizonian aborigines and the introduction of new ornaments by the whites.

One of the most highly prized of these marine shells was a species

of *Pectunculus*,^a which was worked in many shapes, or preserved in practically the same form as when taken from the sea. A number of these were very fresh looking; others were more or less decayed.

Some of the most characteristic specimens are shells with round holes in the middle. It would appear that these are ornaments; and as one of these objects was found near the wrist bone of a man it was judged to be a wristlet. It is suggestive that these perforated shells were generally found in pairs, as though belonging to some dual organ.

Five specimens of perforated *Pectunculus* shells were found at Chaves pass (one of them a fragment smeared with gum), and the same number at Homolobi.

Pectunculus shells were worked into armlets, or large rings,^b by cutting out the whole middle of the shell, leaving the rim, which was ground to a smooth surface. The umbo was carved into a shell-shaped elevation, and the surface was often incised with characteristic designs. The following specimens were found:

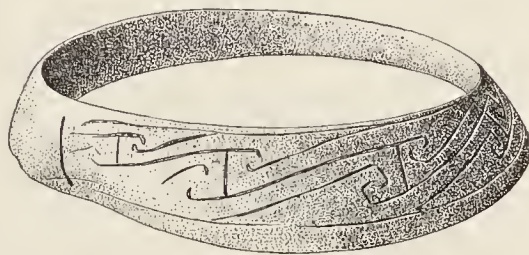


FIG. 46. Incised armlet from Cheylon (number 157843). Diameter about $3\frac{1}{4}$ inches.

Number	Locality and description
157824	Chaves pass; 3 specimens
157659	Chaves pass; 2 specimens
157704	Chaves pass; found on a humerus
157295	Cheylon; with inserted turquoise
157843	Cheylon; with incised design
156760	Homolobi; 2 specimens
157902	Homolobi; fragments

There are also several fragments from an unknown locality.

As a rule, the surface of these armlets is smooth and without ornament, but one specimen (figure 46) was beautifully decorated with a characteristic incised fret covering the whole outer surface. The design consisted of a series of lines interlocking at extremities, though not joining. This figure is one of the simple forms of a characteristic decorative motive widespread over the whole pueblo area. In its simplest expression it appears as two crescents turned in opposite directions, with the two horns adjacent. It is thus painted on the breasts of certain kachinas (personations of supernatural beings), and

^a The following specimens were taken from Homolobi, Cheylon, and Chaves pass: Number of specimens, 114; incrustated with stone mosaic, 1; incrustated with pitch, 1; armlet, incised, 1; armlet, inlaid with turquoise, 1; armlets, not ornamented, 10 (many additional fragments); wristlets, 44 (many additional fragments); finger rings, 30 (many additional fragments); fragments incrustated on wood, 2; carved in imitation of frog, 1; shells not worked, 3; shells with medial perforation, 20.

^b Popularly but erroneously called "earrings."

on shields, or is cut in pictographs. But it is in decoration of pottery that this simple form reaches its highest modification and complication, and it is remarkable how many complex figures can be reduced to this simple type. The horns of the two crescents may elongate and develop into square frets or spiral extensions, and these in turn may be continued into triangular appendages with dentate or serrate margins. They may become terraced figures, their edges so closely approximated as to be separated by zigzag intervals, which in all cases are but the space left by the break. With all these modifications, no matter how complicated, the motive can be reduced to the two horns of adjacent crescents opening toward each other, but not joining. The break is comparable to that in encircling bands drawn on pueblo pottery, called the broken lines or "lines of life." Consider such a line about a vase, bowl, or jar to be broken at several points, or, as the author found in several instances, to have three breaks, and the ends so extended as to overlap the intervals either above or below; modify the extremities thus extended into terraced figures, spirals, or

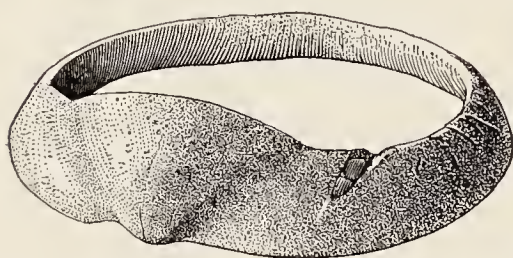


FIG. 47. Armlet with inlaid turquoise, from Cheylon (number 157295). Diameter about $3\frac{1}{2}$ inches.

frets, and we have some of the developments of this most characteristic of all motives in the geometrical designs of decorated Pueblo pottery. This broken line, with its modifications, is used almost universally as a decorative motive by Pueblo potters, ancient and modern, whether living in pueblos, cliffs, or caves. The design on the

armlet shown in the figure is a modification of the same motive.

A single specimen of armlet, shown in figure 47, has a turquoise set in the outer surface near the edge. The stone was probably fastened there with pitch, the armlet being the only specimen of shell inlaid with turquoise in the collection.

The wristlets were made of the same genus as were the armlets, but from smaller specimens. A number of these ornaments were found in some instances encircling the radius and ulna. The majority were from Chaves pass. Twenty-nine complete specimens were secured here, together with many fragments, and one specimen was found at Homolobi.

Bracelets made of this shell are smaller, slighter, as a rule less carefully worked, but more abundant than the armlets. The majority are perforated at the umbo, but the valves are so ground down that there remains no space for the heart-shaped elevation; indeed, the thickness of the shell would not admit of it. Like the armlets, they are sometimes found free in a grave, as though cast there as a votive offering, but there can be no doubt that they were bracelets, for in

more than one instance the author has taken them from the bones of the arm. Similar specimens often have been described as ear pendants, and they may in some instances have served for this purpose, but all of these objects found in the Little Colorado river graves were bracelets.

A number of finger rings made from small specimens of *Pectunculus* were found at Chaves pass.

Two fragments of *Pectunculus* were fashioned in the shape of gorgets. One of these, from Cheylon, was perforated with two holes; the other was crescentic, with a single perforation. The latter was found in a grave at Cheylon.

Unworked specimens of *Pectunculus* were not numerous, but three were found at the Chaves pass ruins, and one at Cheylon. In this connection may likewise be mentioned a clay imitation of a *Pectunculus* shell from Kisakobi, the site of old Walpi.

Two specimens from Chaves pass were smeared with a tenacious pitch and probably formerly incrustated with turquoise, squared fragments of which were found near by.

Three species of *Conus* (*C. fergusoni*, *C. princeps*, and *C. regularis*) were found in pre-historic graves. These were favorite shells for the manufacture of rattles, and they are still used for that purpose by the Hopis. The spire was ground away on a plane at right angles to the lip, making a conical object perforated at the apex. The larger specimens (see figure 48) were probably tied to a short crook, and were used as rattles with which to beat time to the sacred songs. Smaller specimens, found in great numbers on some of the skeletons, served as tinklers, and were apparently tied to garments of the deceased in much the same fashion that the tin cones are appended to the kilts of Snake priests in the Snake dance.

The number of specimens of *Conus*, especially of *Conus princeps*, was large, and the majority were found at the ruin in Chaves pass. One of the best preserved of the specimens is shown in figure 48. This was probably a part of an ancient rattle, and the cut shows the hole which formerly served as the place of suspension. Several of the smaller specimens were found near the pelvis of a skeleton, as though they were formerly tied to kilts, as is suggested above.

A single specimen of the *Turritella* shell was found at the Cheylon ruin, but with the exception of a perforation near the lip it was not worked. At the present day *Turritella* is so highly esteemed that specimens of it are attached by a string to several of the tiponis, or palladia, of religious societies.

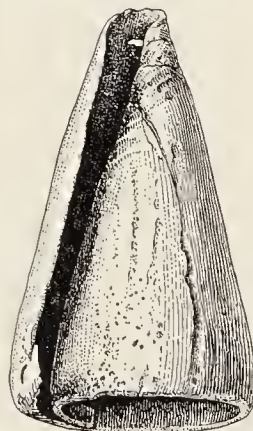


FIG. 48. Shell used for rattle, from Cheylon (number 157847).

Haliotis shells were prized by the ancient Hopi pueblos, and are still highly regarded and used for decoration among the modern Tusayan Indians. Three specimens were found at Chaves pass. These were entire, though very much eroded, when they were dug out of the earth. They were the largest and most beautiful specimens of *Haliotis* which the author has seen from ancient Arizona ruins. Several fragments of this shell were found, all apparently worked, two being perforated for suspension.

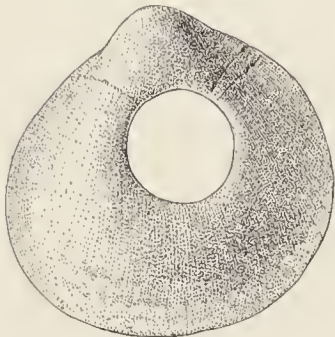


FIG. 49. Shell ornament from Homolohi (number 156391).

A *Strombus* shell from the Cheylon ruin has a ring of pigment about the umbo, but one from Chaves pass is undecorated.

One of the most highly prized for ornamental purposes of all Pacific coast shells was *Cardium*, which made its way by barter in prehistoric times throughout all the New Mexican and Arizonan pueblos.

Figure 50, from Chaves pass, was a nicely carved imitation of a toad or frog. A somewhat smaller shell carving in the form of a frog is figured by Holmes in a former report of the Bureau of American Ethnology.

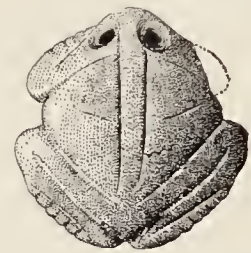


FIG. 50. Shell frog from Cheylon (number 157833). Length about $1\frac{1}{2}$ inches.

The fragment of a shell which the author is unable to identify was found at the Cheylon ruin (figure 51). The figure was elongated, with two lateral extensions arranged in pairs on each side, and suggested a highly conventionalized animal.



FIG. 51. Shell object from Cheylon (number 157251).

The author has no suggestion to make in regard to its former use, and only two specimens of shell carved in this shape were found by him.

Besides these more common shells, many specimens of *Melongena patula*, *Oliva angulata*, and *Oliva biplicata* or *hiatula* were obtained.

The crescentic shell ornament shown in figure 52, which was evidently hung to some part of the body by the hole midway in its length, may have been a gorget, or possibly a pendant for a necklace. Its form is unique.

In addition to the specimens of sea shells which preserved enough of their natural form to render identification possible, the author collected many fragments of unknown relationship.

It is probable that the majority of these belong to some one of the species already mentioned. Of unidentified fragments perhaps the most numerous were shell

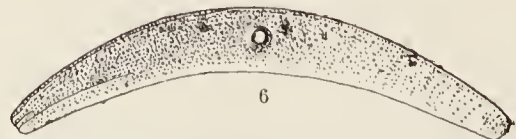


FIG. 52. Shell gorget from Cheylon (number 157850.)

beads, of which there were many hundreds. Some of these were large and of coarse make, but others were so minute that it remains a marvel how they could have been manufactured with the rude implements a stone-age people had at its control. In some instances the perforations were but a trifle larger than the diameter of a fine needle, with rim not over a sixteenth of an inch wide. The thickness of these beads was not greater than that of paper.

All the species of shells which were found in ruins belong to the molluscan fauna of the Pacific, and are still used for ceremonial or ornamental purposes in modern Hopi pueblos. A majority of these have been collected in cliff houses and cavate dwellings, and likewise occur in even greater numbers in the ruins along the Gila and Salado rivers in southern Arizona. Not a single specimen was found which could be traced to the Atlantic watershed, but the source of all was the Pacific ocean, or, what is practically for our purposes the same, the gulf of California. Still more significant is the fact that the art upon them—the symbolism with which they are decorated—is identical with that on the pottery of the ancient sedentary people of southern Arizona.

It may be said that the simple existence of these shells in the ruins from the Gila valley to modern Tusayan can be explained on the theory of barter, and that their distribution does not prove racial kinship of former owners is self-evident. The theory that the same symbolism and treatment of the material originated independently can not be seriously urged in this case. While there is no proof one way or the other that these shells were worked by the people who lived in the ancient ruins, it is probable that the ancestors of the Hopis may have brought them in their migrations from the south. That the culture came to Tusayan from the south appears probable, and Hopi traditionists claim that not only their culture, but also the ancestors of certain component clans of their people came from that direction into Tusayan. So far as archeological researches bearing on this problem are concerned, they verify the claim that the remote ancestors of the Patki people of Tusayan formerly inhabited the Gila-Salado drainage area, and were closely allied to the Pimas, or some other tribe of that slope.

BONE IMPLEMENTS

The collection of bone implements was large and varied in character. In the specimens from Chaves pass, where, from the nature of the country, antelope were abundant, we find a large number of bone implements made of the leg bones of the Cervidæ (see figure 53), but in the ruins of the Little Colorado, that is, Homolobi and Cheylon, bird bones commonly formed the material from which they were made, and few large bone awls were found.

The only specimen of a carved-bone implement is shown in figure 54. It was made from the bone of a deer or antelope, and has a quadruped carved on one end, the head and legs being well represented. The specimen is one of the few found at the small ruin of the Homolobi group near the bank of the Little Colorado, about four miles from Winslow.

The general form of one of the small bone awls is shown in the



FIG. 53. Bone awl from Chaves pass (number 158097).

accompanying cut, figure 53. As a rule, the bone of which they are made is so worked that the rounded end fits the palm of the hand and the sharpened extremity is continued to a needle-like point. These awls are made of the bones of different animals, of which the turkey is the most popular. They were probably used in ancient times in sewing or darning fabrics, possibly in weaving. The modern

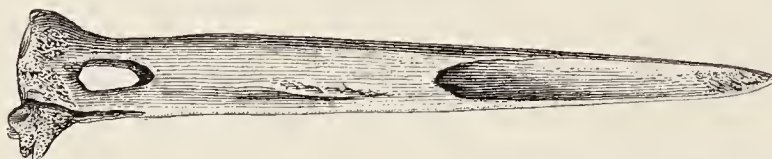


FIG. 54. Carved bone awl from Homolobi (number 157866)

Hopis used a few years ago in weaving a bone awl not very unlike that figured above, but of late they have adopted an iron implement.

At Chaves pass seven small bone awls were found, at Homolobi five, and at Cheylon four.

Sixteen needle-like bone implements with eyes were found at Homolobi; fifteen were obtained at Chaves pass, and three at Cheylon.



FIG. 55. Bone implement from Chaves pass (number 157867).

Another bone implement that was common at the Chaves pass ruins was shaped like a bodkin. Thirteen specimens were found.

A number of bone tubes, some of which were perforated and others not, were found in the excavations. Some of these tubes had holes in the sides, diametrically opposite, and were identified as bird whistles. One of these resembles the whistle still used in ceremonials connected with making medicine in the modern Tusayan rites.

Five specimens of small half-tubes showed evidence of having been attached in pairs, as the marking of the binding string on the bone is still visible. These were probably whistles, the noise being made by a thin edge.

There are several bone tubes which resemble "bone implements" found by Nordenskiöld in the cliff houses of the Mesa Verde, where they are considered "beads made of the humerus of a large bird, probably the turkey."^a Possibly the tubes from Chaves pass may likewise be beads, which, however, is not the case with the Mesa Verde specimens. In the account of the excavations at Sikyatki similar bone beads, found about the neck of one of the skeletons, are mentioned.

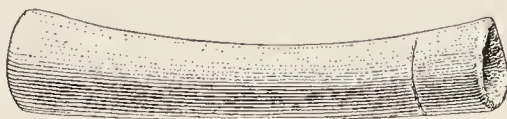


FIG. 53. Bone tube from Homolobi (number 156898).

Sixteen of these bone tube-like objects were secured at Homolobi, three at Chaves pass, and one at Cheylon.

In addition to the common forms of implements already described, many other specimens were obtained. Some of these were too fragmentary to make possible an identification of their former uses. Of these miscellaneous bone implements, eighteen complete specimens and several fragments were secured from the ruins at Homolobi.

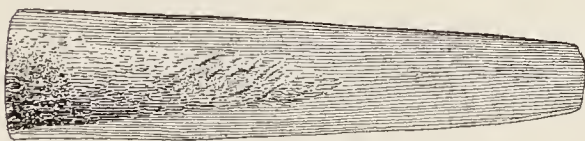


FIG. 57. Stick used by stick swallower, from Cheylon (number 158076).

A very few objects were found at Chaves pass and Cheylon.

The specimen shown in figure 57 is one of the most interesting bone objects in the collection. It is made from a deer or antelope leg bone, is flat on one side and rounded on the opposite, and tapers to a sharp edge at one extremity. It was affirmed by one of the workmen employed by the author that this is the shaft of one of the sticks used by the stick swallowers in their ceremonies.

TURTLE CARAPACES

Near one of the skeletons in the cemetery at Cheylon were found two circular objects made of the carapace of a turtle belonging to the genus *Chrysemeis*, but not the indigenous species. One of these was perforated (see figure 58) and the other was not, but when found both were in four fragments—not broken, but having fallen apart at the sutures. The faces were ground smooth and the whole form had been considerably changed. These disks may have been spindle whorls.

^a The Cliff Dwellers of the Mesa Verde, Stockholm, 1893, pl. XL, fig. 22.

HORN OBJECTS

Two fragments of bone or horn for which the author is unable to assign any use were dug up at Chaves pass. One of these was perforated, and had a number of indentations on the edge imparting to it the appearance of a fire board. It may have been used in kindling fires.

Two fragments of deer horn were found in one grave. These were more or less worn, and one of the Hopis is responsible for the information that chips of similar horns are at the present day drunk with water as a medicine. "The deer," he says, "has a good heart."

PIGMENTS

The custom of placing a small earthen vessel with different colored pigments with the dead was practiced by the people of Chaves pass, Cheylon ruin, Homolobi, and Old Shumopovi. The pigments used were the same as those now employed, and had apparently the same ceremonial significance. As these substances are now highly prized, and as there is every reason to suppose that they were regarded in the same way in ancient times, the burial of pigments with the dead may have been of the nature of a sacrifice.

Some of the modern Shumopovi Indians begged for fragments of green carbonate of copper which were found in the graves of their ancestors, for use in painting their

FIG. 58. Disk of turtle shell, from Cheylon (number 157841). Diameter nearly 3 inches.

ceremonial objects and for other purposes.

Specimens of red paint (sesquioxide of iron), blue paint (azurite), green paint (carbonate of copper), and white paint (kaolin) were found at the various ruins visited. Some were ground, while others were in lumps occasionally in the form of a cylinder or disk.

In his account of the ruins of Sikyatki the author called attention to objects in the forms of disks, cylinders, and the like, which were found in cemeteries of that ancient pueblo. Their uses were said to be problematic and he now has to record the finding of other objects of the same nature and form which are equally enigmatic (figure 59). One of these from Homolobi is a hemispherical fragment of kaolin,

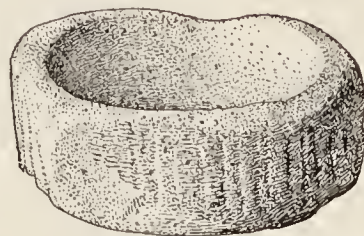


FIG. 59. Kaolin cup from Chaves pass (number 157928).

recalling those exhuméd from Sikyatki; there was also a cylindrical object of the same material from the Cheylon ruin, but the most exceptional specimen was a disk-formed object of kaolin with a depression in one side, resembling a small mortar. These various forms into which the easily cut kaolin is worked would seem to have served some important office, the nature of which is unknown to the author. Kaolin at the present day is used for whitening cotton blankets, sashes, and kilts, and for painting the bodies and limbs of those who participate in sacred festivals. Possibly some of these fragments are simply pigments.

CLOTH

Considering the number of graves opened in the course of the excavations, it is remarkable that so few specimens of cloth were found. This may be ascribed, not to the poverty of the inhabitants of the ancient villages in woven fabrics, but to the rapidity with which cloth decays in the moist soil. One or two of the specimens which were found were preserved by the copper carbonate with which they were

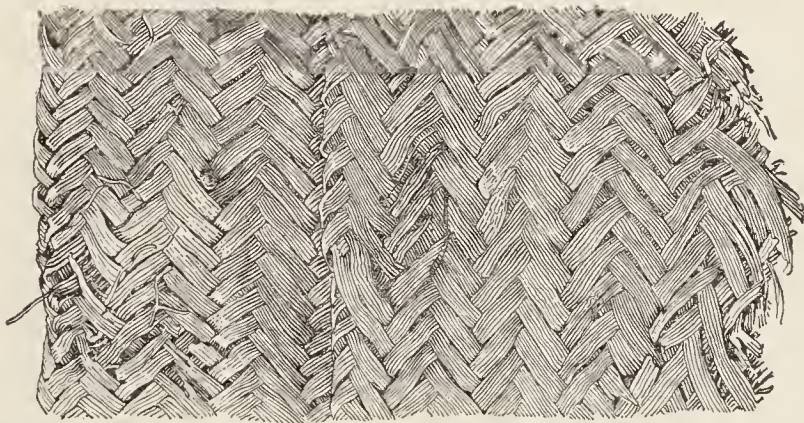


FIG. 60. Matting from Cheylon (number 157912). About 5 by 2½ inches.

in contact, but the fragments were small and the manner of weaving difficult to discover. From one of the specimens it appears that the hair of some animal was used, and there is no doubt from others that yucca fiber was extensively employed. The impression of string was observed on several sticks, but the string itself was too much decayed for identification.

Two fragments were discovered at Homolobi and one at Chaves pass.

MATTING

It appears that the bodies of the dead, especially at the Cheylon ruin, were wrapped in matting, fragments of which were in many instances well preserved. This matting was a loosely woven fabric, made of vegetable fiber which the author is unable to identify, and

was most abundant in the Cheylon ruin. It does not appear to be common in the interments at Chaves pass, and was only sparingly found at Homolobi.

In the accompanying cut (figure 60) a portion of one of the best specimens of this matting is shown as a type. The specimen from which this fragment was taken is large, ample enough to cover the head and parts of the shoulders.

BASKETRY

The specimens of basketry found in the ancient burial places were of two kinds, one corresponding with that now made at Oraibi and

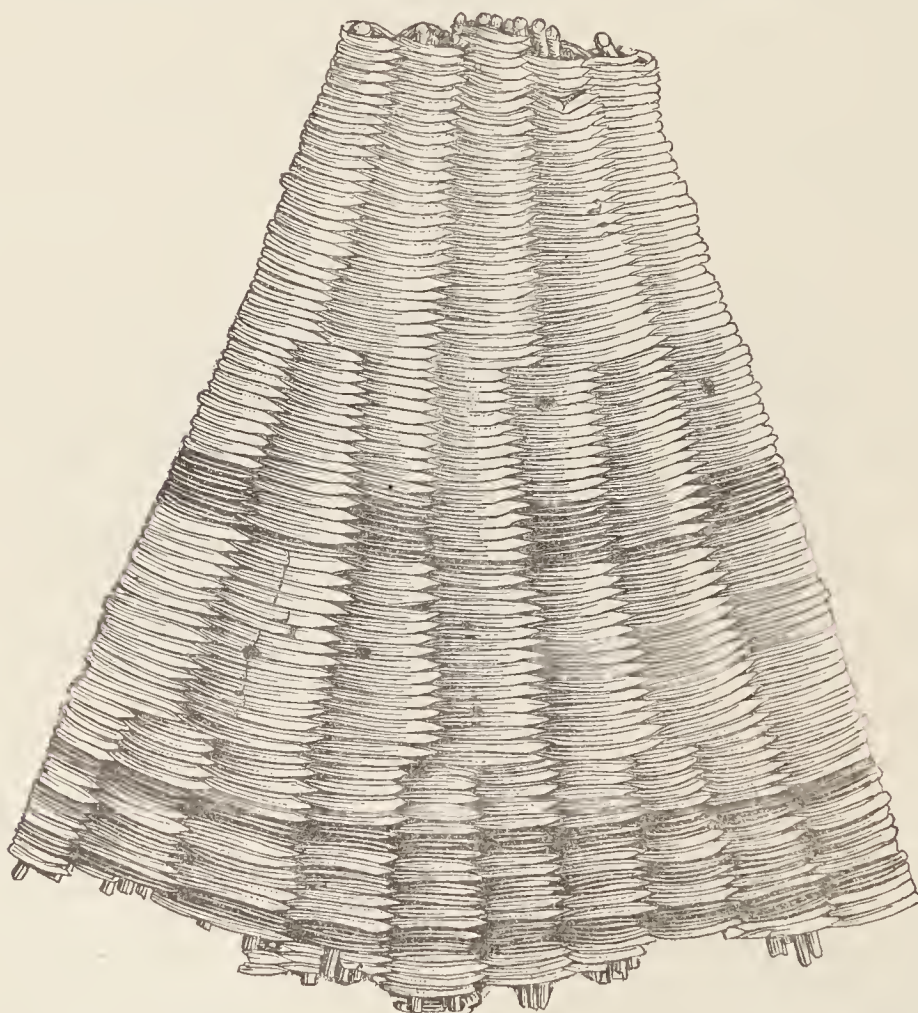


FIG. 61. Basketry of Oraibi type, from Cheylon (number 157918). Length about 5 inches.

another similar to the basketry of the Middle mesa. It was the custom to bury these objects with the dead, as is still a common usage in Tusayan, as receptacles for food and as other mortuary offerings. These baskets were ornamented with woven patterns, and in some instances were covered with a thick layer of green, blue, or red paint. In form they were generally plaque-like, but one of the specimens

which was almost entire was deeper and basket-like. All were browned with age, and the majority of specimens were fragmentary.

One of the best specimens of the Oraibi style of basketry is shown in figure 61, which represents a sector of a plaque in which the colors are still preserved. The manner of plaiting this basket is the same as that practiced at the Hopi pueblo, as is shown by the accompanying cut, figure 62.

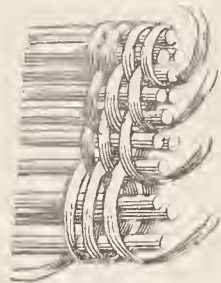


FIG. 62. Basketry of Oraibi type, showing manner of plaiting.

The inhabitants of ancient Cheylon were familiar with the method of making basketry by coiling, as at the Middle mesa of the Hopis to-day. There are many specimens of this ancient coiled basketry in the collection, but the specimen shown in figure 63 is one of the most perfect found. The design is the same as that shown on some of the ceramic objects.

One specimen of coiled ware and two fragments were found at Chaves pass, and twelve specimens of coiled ware and two of the Oraibi pattern at Cheylon.

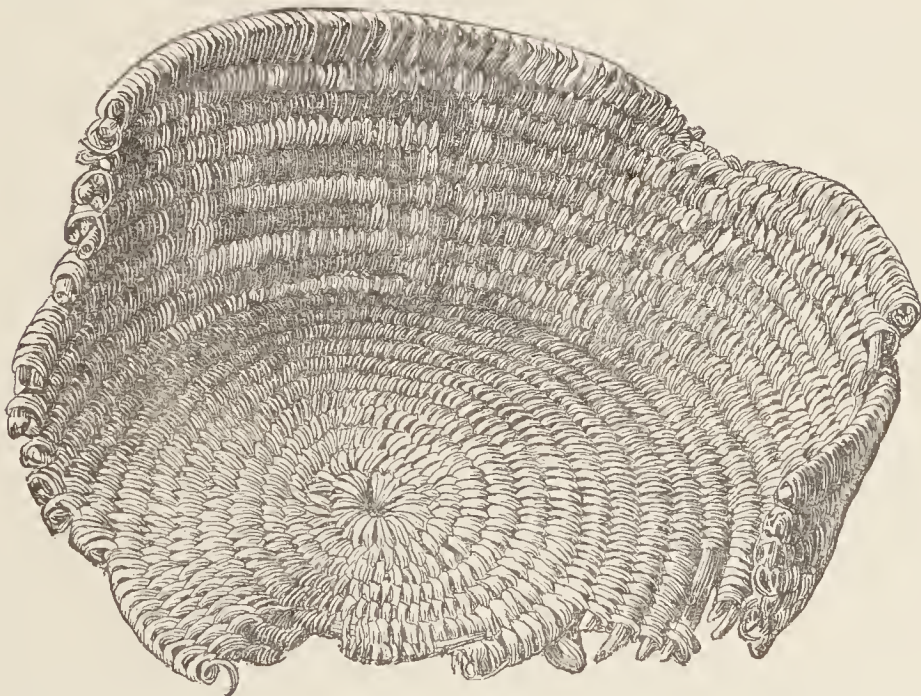


FIG. 63. Basketry of coiled type, from Cheylon (number 157915). Diameter about 5 inches.

PRAYER-STICKS

Several forms of prayer-sticks, or pahos, were collected from the different ruins in 1896, but the majority were so decayed that their original forms were unrecognizable.

Small prayer-sticks painted green were found at Shumopovi, and these were apparently not unlike those now used in the neighboring pueblo.

The pahos from Chaves pass were painted bright blue, the pigment used being azurite. These had a single stick as long as the arm, between a half inch and an inch in diameter, and were apparently laid by the side of the body when buried, in some instances resting on the left arm. So thoroughly decayed, however, was the wood of which they were made that it was difficult to take an unbroken specimen from the earth.

An unusual form of paho was found in a grave at Chaves pass. It consisted of a wooden disk with a short handle, and was not unlike a hand mirror. The whole object was painted green, with an obscure figure in red on one face. The disk was perforated in the middle, and there were markings or impressions of feathers on the green pigment with which it was painted. In one of the graves a spheroidal wooden object was found, with daubs of pigment upon it, which recalls the squash pahos found in the Awatobi shrine, and has likenesses to the modern prayer eagle eggs made of wood, such as can be found in a shrine at Tūrkinobi, near Walpi.

The pahos from Homolobi and Cheylon are small, and as a rule are painted green with copper carbonate. They were neither as finely made nor as complicated as those of Sikyatki, where the best ancient prayer-sticks yet found have been obtained. In the Chaves pass graves the prayer-stick was very long and painted blue with azurite or green with carbonate of copper.

The most interesting and exceptional form of prayer-stick collected in 1896 was that obtained at Cheylon. It was disk-like in form, had an attachment at one end or on the rim, and was painted green and decorated with red designs. The author has found no similar prayer-stick in use in any Hopi ceremonial which he has witnessed.

BOW AND ARROWS

Almost a complete bow and several fragments of arrows or reeds were dug out of a grave at the Cheylon ruin. These were taken from the same place as the gaming reeds about to be mentioned. The association of gaming implements and the weapons of a warrior in the same grave is highly suggestive.

GAMING CANES

One of the mortuary bowls excavated from the Cheylon cemetery contained five half canes (figure 64) which recall those used in the Zuñi game known as sholiwe.^a These reeds are not, however, marked as are those now used at Zuñi, and differ from those found on a bowl from Shumopovi (figure 74). The author believes, however, that the game in which they were employed was practically the same.

^aSee Owens's figure of sholiwe reeds in *Popular Science Monthly*, May, 1891. According to Owens, four pieces of reed are employed in this game by the Zuñis. The manner of throwing the reeds is clearly indicated by this author.

One or two food bowls were found in which figures of these gaming reeds are painted on the inside of the bowl, as is mentioned later in this report.

SEEDS

Many of the food basins contained seeds of maize or squash, and ears of maize from which the kernels had decayed were found in several bowls.

The ears or cobs show that the maize was a small variety, like that found in cliff houses and still cultivated by the modern Hopi farmers. The occurrence of squash seeds in some of the mortuary bowls is important, indicating the ancient use of this vegetable for food. It may, in this connection, be borne in mind that one of the southern clans of the Hopi Indians was called the Patuñ or Squash family, which is still represented at Oraibi and the Middle mesa, although it is extinct at Walpi. Numerous other small seeds too shriveled for identification were found in the mortuary offerings in the cemeteries of Homolobi and

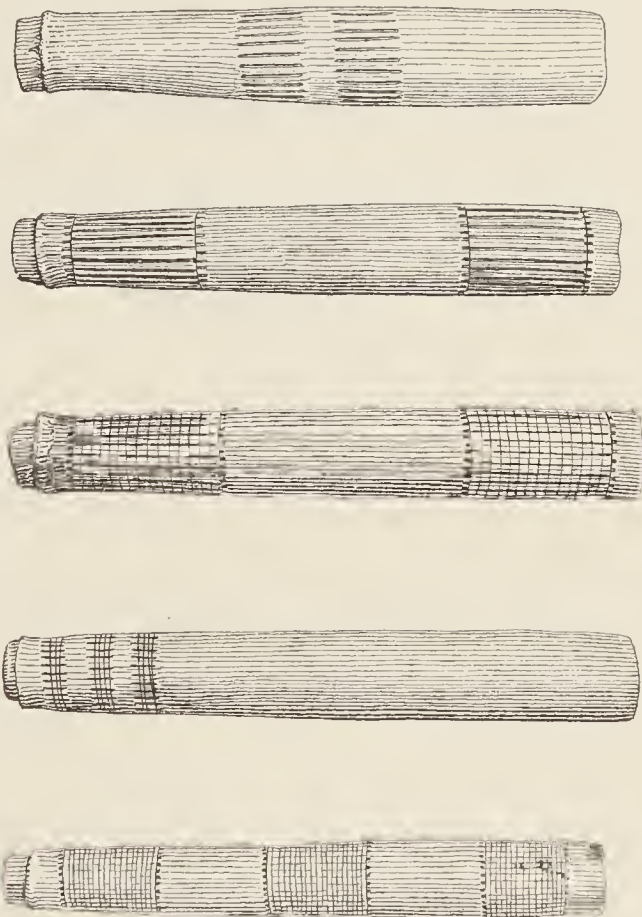


FIG. 64. Gaming canes from Cheylon (number 158030). Length about $3\frac{1}{2}$ inches.

Cheylon. It would seem from the nature of a matrix in which they were inclosed that they had been boiled or cooked in some way.

FOOD

Almost every bowl found in the cemeteries contained fragments of what appeared to have been food, but in most instances this was too much destroyed to be identified. It was ordinarily in the form of a thin film coating the interior of the bowl, and was penetrated by roots which had found their way from the surface of the ground. There is little doubt that in some instances this food was one of the many kinds of corn bread so common among the modern Hopis.

STONE IMPLEMENTS

In the type "pounding stones" are included stone implements, ordinarily of small and medium sizes, showing marks of battering at one or both ends. Apparently they were not attached to a handle, and the indication is that they were simply held in the hand when in use. With these pounders various substances were bruised, pigments were ground, hide was made more pliable, and similar processes

were effected. Any rounded stone convenient to handle appears to have been taken for this purpose. At Homolobi thirteen stone objects were found which were doubtless used as pounding implements, at Chaves pass four, and at Cheylon two.



FIG. 65. Stone implement from Homolobi (number 157895). Length about 6½ inches.

Stone axes were even more common. At Ho-

molobi twenty-four specimens were found, at Cheylon two.

Several weapons made of a black stone, one of which is shown in figure 65, were collected at Homolobi. These were evidently either celts or spearheads, for there was no sign of hafting or of polishing, and marks of fracture were apparent.

The specimen represented in figure 66 is of white stone, possibly aragonite; it was the only weapon of this material which was found. The shape is regular and the surface smooth, and there is a groove for a handle. It has four grooves cut on one edge and incised crosses,

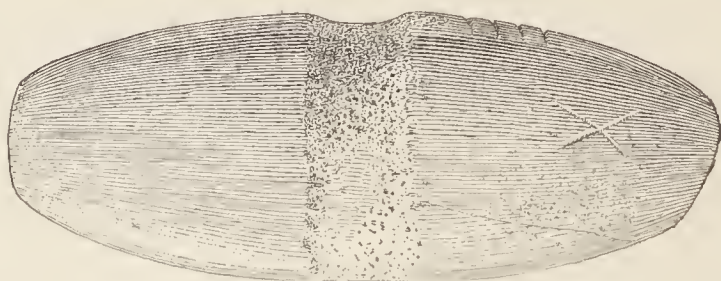


FIG. 66. Stone ax from Homolobi (number 157024). Length about 7 inches.

two in number, one of which is shown in the cut. No indication of a handle accompanied this implement, which leads the author to suppose that that part was of wood, which had long ago decayed.

There were several stone implements with a cutting edge on one side which were probably used as knives. These are sometimes curved, but generally straight. The best stone knives are two from the Cheylon ruin.

Several of these knife-like objects had dentate edges, as though used for saws.

The author has elsewhere noted the frequency with which fragments of obsidian, and chips from the same, occur in ancient Pueblo graves, or on the surface of mounds, indicating ruins. The three sites of explorations in 1896 were not exceptional in this particular, and a somewhat limited amount of material of this nature was collected at Homolobi, Cheylon, and Chaves pass. This material was prized in ancient times for arrow points, spearheads, and knives, and the sharp edges of many of the chips were probably used for cutting.

Arrow points were found in large numbers at the various ruins visited on the Little Colorado.

The present Hopi Indians use a grooved stone for polishing arrows. These stones are ordinarily of a coarse sandstone, which acts as a file on the wooden object rubbed back and forth in the groove. Similar polishing stones are very common in ruins, assuming a number of shapes, and made of several different kinds of rock—as sandstone, lava, slate, and even clay. It is probable that these stones were used for the same purpose as those employed in the modern kivas, as their form has not changed from ancient times.

The differences in the polishing stones from the ruins at Homolobi, Cheylon, and Chaves pass were not very great, as the simplicity of the implement admits of but few varieties. Those from Chaves pass were made of lava, which occurs only rarely in the other two ruins. There were double- as well as single-grooved polishing stones, and shallow- and deep-grooved ones. It is possible that some of the perforated stones may have been used as polishers for arrows in much the same way as the modern grooved stones are employed. One of these arrow polishers had the shape of an animal, and was narrowed to a head at one end. On this end was cut a mouth and two depressions in the proper positions for eyes. The surface of the stone on the side opposite that occupied by the groove was flat and smooth, so that the object could be firmly placed when in use.

It appears to have been a mortuary custom among the people who lived in the ancient pueblos along the Little Colorado to deposit with women and girls at death a metate and its grinder. These were ordinarily reversed when buried, as though symbolic of the death of the one who formerly used them. In one of the Homolobi graves three of these metates with their corresponding hand stones were found, and these were added to the collection. They were made of rocks of different degrees of smoothness, and were evidently formerly used in grinding corn in the same way as in modern Hopi pueblos. The maize was bruised and roughly ground on one of these stones, then it was passed to a finer-grained one, and ultimately to the finest of all. These metates were much worn, showing long and constant use.

Many large and very heavy metates made of lava rock were found at Chaves pass, but these were not brought to the railroad. Several of these were worn so deep in one face as to form troughs. If there were no other evidence of long occupation of this ruin the deeply worn metates would furnish it. These metates were bulky, and were quarried in the bad lands of the vicinity of the old pueblo. It is instructive to note that metates, rather than smaller and more portable stone objects, show the influence of geological environment, for as a rule their size requires that they be made of the rock contiguous to the ruin. Sandstone metates are commonest in the valley ruins, lava in those built of lava rocks. The same is true of the stones of which the walls of the ancient habitations were constructed.

The material of the grinding stones is the same as that of the metates. They are for the most part simple elongated slabs, sometimes with depressions along the sides to enable the manipulator to obtain a stronger hold. Like metates they show the effect of wear on one face, being generally rounded on the upper surface. Several of these stones are double faced, or when seen in profile they are triangular. These specimens, which are of softer and finer rock than the others, were undoubtedly used in the last stage of grinding the kernels of corn into fine meal. Ten of these meal grinders were found at Homolobi and Cheylon.

Stone implements of mushroom form are among the interesting objects obtained in our excavations. These are well adapted for paint or pigment grinders.

The mortars in which paint is ground are ordinarily small stone slabs with a depression in one face. These are sometimes rectangular in form, often circular, and the depth of the depression varies, being frequently very slight. The same variety of paint mortars is in use to-day, and many of these stone objects now used in the kivas are no doubt very ancient. The small stones with one flattened face were doubtless used as grinders; in some instances they are much worn. The list of paint mortars includes two from Homolobi and three from Cheylon.

STONE SLABS

The use of slabs or slabs of stone decorated with figures painted in various pigments has been described in accounts of several Hopi altars. One of the most remarkable of these is probably the stone called the Hókona mana, or Butterfly virgin, which is used in the construction of the Antelope altar at Walpi. Two flat rectangular stones stand back of the sand picture of the Antelope priesthood in the Snake rites at Shumopovi, while the use of similar stones in the various Flute altars may be seen by consulting articles on these rites.

Of a similar nature, no doubt, is the painted stone slab shown in plate XLVI, found in a grave at the Cheylon ruin. This object, which is much larger than any of those which have been mentioned, is painted

on both sides with highly suggestive designs of a symbolic nature. The decoration on one side is almost wholly obliterated, but on one corner we detect clearly the modern symbols of the dragon fly. The pigments with which this stone is painted were easily washed off, and this accounts for the loss of the decoration on the surface which was uppermost as it lay in the grave over the body. The design on the other face, however, is more distinct. It consists of three triangular figures inclosed in a border, recalling a sand mosaic such as is used in modern presentations of the Hopi ritual. Two colors, black and white, are readily detected in the border—the black outside the white. The field inclosed by this border is yellow, and the three triangular figures are black, with inclosed rectangles, which are white. At the apex of each triangle there is a rude figure of a bird painted red, in which the head, body, and two tail feathers are well differentiated.

The whole character of the design on this stone calls to mind the decorations on the walls of a kiva of a cliff dwelling of the Mesa Verde, described by Nordenskiöld, and figured in his beautiful memoir. In the designs on the kiva wall of "ruin 9" we find groups of three triangles arranged around the whole estufa at intervals on the upper margin of a dado, and each of these triangles is surrounded by a row of dots. The field on which they are painted is yellow, and the triangles and dots are red or reddish brown. On a wall of Spruce Tree house Nordenskiöld found a similar dado with triangular designs, and it is interesting to note that in the figure of this ornamentation which he gives rude drawings of birds appear in close proximity to the triangles.

The interpretation of these figures must be more or less hypothetical. The custom of ornamenting house walls with a series of triangles on the upper margin of a dado is still observed in the modern Hopi villages, where, however, the position of the triangular designs is reversed as compared with that of those on this stone slab.

The triangle is a symbol of the moth or butterfly, which, while appropriate on women's blankets or house walls, would hardly appear to have special significance on the slab in question. Still, as has been pointed out, one of the most venerated objects on the Antelope altar has the figure of a butterfly upon it.

Much more likely is it that these three triangular figures surrounded by birds are rain-cloud symbols, and that this slab of stone was formerly used in a ceremonial which had for its object rain making, and to this conclusion the dragon-fly symbols on the reverse side also point. This stone is an altar slab with rain-cloud symbols.

In the Cheylon ruin the author found several flat stones, one of considerable size, which were marked with blackened circles. The largest of these, fully 3 feet square, was not brought to Washington, and the photograph which was made of it soon after it was

removed from the grave was a failure. These circles, apparently made by smoke, are of unknown origin and use. On the largest stone they are arranged in two rows, four in each row, the peripheries touching. The stones were inverted when found, and occurred in the cemetery at Cheylon only.

Many graves at Cheylon and Homolobi were, as has been stated, indicated by upright stones or flat slabs of rock. As the digging went below the surface it was sometimes found that the skeleton was covered by a similar flat rock, and in a limited number of cases these rocks were perforated. The holes were sometimes not larger than a broom handle, often capacious enough to permit the insertion of the arm, and in one instance a foot or more across. Oval, round, and rectangular orifices were found, and in several cases a considerable amount of labor must have been expended in making them.

Slabs with the smaller circular holes were also found in the floor of a room where there was an intermural burial. Explanations more or less fanciful have been suggested for these perforated stones, one of which was that the rock had been placed above the body and the hole in it was for the escape of the soul or breath-body. The slabs were found above the bodies of several deceased Homolobeans, and the modern Hopi interpretation of the perforation is offered for what it is worth.

DISKS

Small disks were found in all the ruins which were studied, and while these had like forms they were made of various substances, as of stone, pottery, and shell. They are generally circular in form, rarely perforated, and often ground on their edges. The unperforated specimens are supposed to have been formerly used to cover a hole in a jar in much the same way as similar fragments are now used in flower-pots. The perforated specimens were probably used in much the same way as wooden disks are employed in modern pueblos, as parts of drills for perforating stones, shells, or other hard substances. The specimens of this problematic group of objects, and the localities from which they were gathered, are mentioned in the appended list.

Number	Locality and material
158056	Chaves pass; stone
157706	Chaves pass; red pottery
158079	Chaves pass; red pottery
158078	Cheylon; red pottery
158080	Cheylon; red pottery
157963	Cheylon; stone
156480	Homolobi; pottery
157965	Kisakobi; pottery
158093	Little Colorado ruins
158164	Jeditoh; shell
158165	Jeditoh; shell
158060	Chaves pass; galena
158095	Cheylon; wood

FETISHES

The number of graves in which smooth, waterworn stones, quartz crystals, and fossil cephalopods occur in other ruins has been noted in the account of Awatobi and Sikyatki. A considerable number of these objects were found in the Little Colorado ruins; the fossils included a tooth and remains of several erinoids and of an ammonite.

Similar objects are still used in Hopi ceremonies, and it is well to call attention to the fact that some of the priests begged the author to give them these ancient objects that they might use them in the preparation of medicine and in other sacred or ceremonial ways.

Some of the smooth stones may have been used in polishing pottery, but this can hardly be said of the quartz crystals and the botryoidal specimens.

Fossil cephalopods, called koaitcoko, although very common in the rock strata underlying the modern pueblos, are sometimes looked upon by the Hopis with great reverence, and are used in several modern ceremonies. One of the best-known instances is in the tiponi of the Lalakoñti, described in an account of the unwrapping of that palladium, as follows:^a

The chief priestesses and Kwatacwa then untied the bundles upon the altar. They first unwrapped the buckskin thong which bound one of them and took from the top a large number of sticks of different lengths, to each of which numerous feathers were tied. In the midst of these sticks there was an ear of popcorn surrounded by a mat made of eight black feather-sticks tied together. This mat, surrounding the corn, rested upon a cloth. Removing this cloth from the cradle, there appeared below it a nicely folded piece of buckskin painted on the border, with the rain-cloud ornaments painted black, the falling rain being represented by fringes. Within this skin there were many breath-feathers and a single reed,^b to which feathers were tied. Below the buckskin there were many bean and melon seeds. Within the bundle of breath-feathers there was a fossil shell, fragments of another, and the piñon branch. The basket itself, which forms the cradle, was made of a continuous coil of wickerwork, rectangular in shape.

When the priestess had undone this bundle, the contents of which were considered so sacred that we were not allowed to touch them, she carefully repacked it. She first put in the seeds of beans, corn, and melons, and then a number of breath-feathers. She sprinkled these with metallic iron dust [micaceous hematite] and added a piñon branch (pine needle). On these she placed the cloth in which the fossil shell was tied and the reed with its feathers. Above this she tied around the ear of corn the old prayer-sticks, to which she added a new one which she had prepared. The black sticks were said to be old men and the seeds to be food. The fossils, which are called koaitcoko,^c were found later to be one of the numerous cephalopod fossils abundant in certain places. It was said that these sacred specimens came up from the under world. The contents of each bundle were substantially the same.

It will be seen from this quotation from a description written in 1892 that one of the most sacred objects in the bundles before the reredos

^a The Lalakoñti; A Tusayan Ceremony, in the *American Anthropologist*, v. 5, p. 121, April, 1892.

^b This resembled the so-called reed cigarettes used in other ceremonies.

^c The same name was given for the whole bundle.

of the Lalakoñti altar was a fossil cephalopod, which, so far as could be judged, was of the same species as some of those taken from the Little Colorado ruins in 1896 and from Sikyatki in 1895.

The ceremonial use of fetish stones in modern Hopi rites has been described by the author in several publications, from which the following quotation^a is taken as one of the most complete:

Saliko brought from her house six ears of corn, a crenellate vessel [medicine bowl], and another bag of fetishes. * * * Saliko took a handful of meal from a tray at the poñya [altar], prayed upon it, and then, kneeling about 4 feet in front of the altar, sprinkled intersecting lines. She placed the crenellate vessel in the center, and then arranged ears of corn upon the lines, beginning at the northwest, where she placed a yellow ear, followed by a blue, red, white, black, and an ear of sweet corn, as shown in the diagram. From her bag she took out six smooth waterworn pebbles, the largest of which was $1\frac{1}{2}$ inches by three-fourths of an inch in size, and placed them close beside the ears of corn. Beginning at the yellow ear, she laid down by it a piece of opaque quartz with a smoky iron streak; at the blue, a piece of the same with a faint bluish tinge; at the red, a piece with a reddish tinge; at the white, a piece of translucent quartz; at the black, a piece of shining black iron ore, and at the last, a crystal of bluish quartz.

Less detailed is the author's description of the use of these rock crystals in another Hopi ceremony:^b

The priest, Ametola, first made a bed of fine field sand on the floor, and then rapidly traced on the sand three cross-lines of meal, corresponding to the six primary directions. Over their junction he placed a medicine bowl, but not that before the altar. Around the bowl he laid, at the ends of the lines of meal, six ears of corn, with points directed toward the bowl. Beside each ear of corn he placed an aspergill and a rock crystal. Within the bowl he dropped several rock crystals and a little honey.

In the Naaenaiya, or New-fire ceremony, smooth pebbles and quartz crystals likewise play important parts in making medicine:

He placed the first group of six skins upon the meal lines, as indicated in the diagram. He then arranged the ears of corn upon the skins, and close beside them he placed the six pebbles (each having some requisite peculiarity, but no opportunity offered to examine them closely), and finally another set of six skins was deposited upon the right of those first laid down. . . .

Eight songs were sung while he was placing these objects, and during the singing of another group of eight songs the asperser laid the pebbles in the nakwipi [medicine bowl], and then rested the ears on end within it. He then slightly dipped the tail or the distinctively colored end of each bird skin and each feather tip into the water, afterward laying it down in the place from which he had taken it. He also sprinkled pollen in the bowl, and aspersed to the six directions with each ear of corn as he took it out and laid it in its former place. The song was an hour and a half long, and just as it closed the asperser took from one of the chief's bags a quartz crystal. Sucking it, he passed it to a young man sitting near, stitching a kilt, who went up the ladder and reflected a ray of sunlight into the nakwipi, and afterward the crystal was put into the liquid.^c

In the Niman Katsina (festival celebrating the departure of the katsinas) we find these crystals and medicine stones likewise used

^a American Anthropologist, v. 5, p. 221, July, 1892.

^b American Anthropologist, v. 5, p. 117, April, 1892.

^c Journal of American Folklore, v. 5, p. 192-193.

in mixing the charm liquid, as the author has elsewhere described as follows:^a

Upon the ears of corn were then laid the nakwiowa, small quartz crystals, elongated, black, pipestem bodies and shell beads. One or two of these were placed on the end of each ear of corn at a point nearest the nakwipi, one behind the other. Two similar quartz crystals were placed in the nakwipi. These sacred stones were laid on the corn in the same order as above mentioned for the ears of corn and aspergills. Intiwa's assistant then took a quartz crystal, one of the nakwiowa, and, standing on the lower round of the ladder leading out of the kiva, held it in the direct rays of the sun and threw the reflection into the water contained in the nakwipi. This ceremony, by which a ray of light from the sun (Dawa) is introduced, was observed in silence. . . . After several strains of this and other similar songs had been sung, Intiwa's associate took up the ear of corn on the north side of the bowl, held its end over the nakwipi, and, pouring water (liquid) from a small spherical gourd upon it, washed off the medicine stones into the nakwipi with great solemnity. . . . After the washing of these stones into the liquid, a song with quicker time and more rapid motion of the rattles was taken up and continued for some minutes.

The above quotations from descriptions of ceremonies, and others which might be mentioned, show how often small waterworn pebbles, or quartz crystals, are used in making charm liquid or "medicine" by the modern Hopi Indians, and the same kind of stones discovered in ancient graves probably had a similar use among the ancients. Indeed, one of the quartz crystals from a grave was appropriated for his altar by a Shumopovi priest.

The use of two small stone cylinders, one of lava (number 157984) and the other of a light gray stone (number 157983) each having a pit or depression in the end, is problematic. Similar shaped stones are sometimes used in modern Hopi ceremonies to indicate the zenith.

Among the fetishes found in Homolobi graves may be mentioned a rude bird made of unburnt clay,^b the only specimen of animal effigy which was found in all the excavations in 1896. On the surface of one of the mounds of the smaller ruin at Chaves pass, however, the author picked up a small imitation of some unknown animal, which was rudely carved, and reminded him of the so-called "hunting stones," or fetishes, of the Zuñis.

The occurrence of rude effigies of animals in prehistoric Arizonian graves may possibly be interpreted as substitutional sacrifices, and if this interpretation is correct, it would seem that in ancient times birds, which are now represented by effigies, were sacrificed. It is much more likely, however, that these images represent animals which the ancient worshipers desired, and that they were forms of prayer by signatures. Small figurines of domestic animals are made for this purpose at the present day by the Hopi priests.

^aJournal of American Ethnology and Archaeology, v. 2, 1892, p. 75, 76, 77.

^bThis effigy is very unlike the burnt clay imitations of birds which have been described in the author's account of the ruin Awatobi. It is very rudely made, simply pressed into shape by the fingers, and is without decoration. The Awatobi clay birds are probably used as pendants, while that found at Homolobi appears to be simply a mortuary offering.

HUMAN CRANIA

A particularly fine collection of crania was obtained in 1896 from Cheylon and Chaves pass. One specimen from the latter place had the facial and frontal bones stained green.

ANIMAL REMAINS

Although the prehistoric Pueblos of Arizona and New Mexico apparently had no sheep, horses, or cattle, they domesticated several animals, and used many more for food. The bones of these animals occur both in houses and graves—more abundantly in the former, especially in the Homolobi ruins, where the author made a considerable collection of them. They have been identified by Mr F. A. Lucas, of the National Museum, and are as follows:

- Canis familiaris*, domesticated dog; a cranium of the broad-skulled Eskimo type.
- Canis frustror*, coyote; probably jaw and leg bones.
- Felis concolor*, puma; jaw of young.
- Lynx rufus*, wild cat; jaw.
- Taxidea berlandieri*, badger; two claws.
- Cariacus macrotis*, mule deer; leg bones, antlers, and part of jaw.
- Antilocapra americanus*, antelope; leg bones, part of jaw, and horns.
- Castor canadensis*, beaver; collar bone.
- Lepus texianus griseus*, jack rabbit (many specimens).
- Lepus arizonae minor*, small rabbit (many specimens).
- Cynomys*, prairie dog; skull and odd bones.
- Ovis canadensis*, mountain sheep.
- Spermophilus*, ground squirrel; tooth.
- Thomomys*, gopher; skull.
- Corvus corax sinuatus*, raven; wing bone.
- Bubo virginianus*, great horned owl; tarsus.
- Aquila chrysaetos*, golden eagle; claw.
- Buteo borealis*, red-tailed hawk; wing bones.
- Cathartes aura*, turkey buzzard; wing bones.
- Meleagris gallopavo mexicana*, turkey (many specimens—some of young).
- Grus mexicanus*, sandhill crane; wing bones.
- Anas* sp., duck; part of sternum.
- Phalacrocorax* sp., cormorant; 1 bone.

MISCELLANEOUS OBJECTS

The manner of building the roofs and floors in the Homolobi ruins was practically the same as in the modern Tusayan pueblos. A large number of rafters were taken out of the walls, many of which were in place, while some had fallen in, broken by superimposed weight. In several instances these beams were well preserved; in others they were much decayed. Several fragments of the clay with which the roofs were covered were collected, and in one impressions of reeds were evident.

Asbestos appears to have been considerably prized by the inhabi-

tants of the Chaves pass ruins, and a single specimen was added to the author's collection from these ancient towns.

A few fragments of a bird's egg, too broken to be accurately identified, were collected in a grave at Homolobi. This was possibly an eagle's egg, and it may be mentioned that in certain Hopi ceremonials at the present day imitations of eagles' eggs made of wood are at times placed in modern shrines. The author has no knowledge, however, of a modern mortuary use of birds' eggs, but suspects that the egg of the turkey, which we know was domesticated by the ancient pueblo people, may have been eaten by them. If this supposition be well founded, the fragment of birds' eggs in a grave at Homolobi may be a remnant of food offerings.

A single specimen of galena was taken from a grave at Chaves pass. This mineral was probably used as a pigment, but it is not common, and is not used by the modern Hopis in painting the body or any of their ceremonial paraphernalia.

A small copper bell was found in a grave at Chaves pass. This object is shown in figure 67, from two faces. It was apparently formed of beaten native copper, but the eyelet would seem to indicate a knowledge of soldering. One side was so broken that a small spherical body which served as a clapper could be easily seen. The metal was much corroded, but not so much as to prevent the bell emitting a sound when shaken.

Among other miscellaneous objects taken by the author were a fragment of potter's clay from Homolobi, a sulphur nodule and several dried lizard tails from Chaves pass, a fragment of asphalt and some perforated cedar berries from Cheylon.

Several rectangular fragments of red pipe clay, one of which was perforated as though for suspension, were found at Homolobi.

The object of the large and small rectangular or trapezoidal plates of mica and selenite found at Homolobi and at Cheylon, in graves and elsewhere, was not wholly clear. No specimen, however, was brought back from Chaves pass, and no natural deposits of selenite were noticed in the latter locality.



FIG. 67. Copper bell from Chaves pass. Diameter about $\frac{1}{4}$ inch.

RUINS OF OLD SHUMOPOVI

GENERAL FEATURES

Although in the report of the author's excavations at Awatobi and Sikyatki, in 1895, an extended account has been given of the archeology of pueblos near the East mesa, no work was done on the numerous ruins at Oraibi and the Middle mesa. The author was particularly anxious to compare pottery from some of these ruins with the beautiful series which had been collected in 1895 at Sikyatki, espe-

cially as numerous specimens had been sold to traders from Old Shumopovi, and almost all of these were identical with those from the East mesa.

There is evidence that Shumopovi was one of the oldest settlements on the Middle mesa, but the legends of this pueblo have never been carefully studied, and the component clans are practically unknown. The pueblo stood in the foothills near a spring when the Spaniards first came into the country, and its name can easily be recognized in Espejo's list of Hopi towns at the end of the sixteenth century.

There is a uniformity in statements that the founder of Oraibi, Matcito, lived in Shumopovi before he sought the cave where he lived when Oraibi was built, and probably Shipaulovi was founded by clans from it in the eighteenth century. The size of the old ruin shows that in ancient times it had a large population.

The record of work at Old Shumopovi can be given in a few lines. For several years it has been known that a wealth of beautiful pottery lies buried in the cemeteries of that ruin (plate LII). That the number of objects destined to be removed from this place is large is probable from the great size of the cemeteries and the small portion of them which has yet been dug over. The author therefore began work with high hopes of a great harvest. About twenty Indian workmen from the East mesa and a few from Shumopovi were employed as excavators, and in the first two days of work they took out of the burial places over one hundred specimens.

On the evening of the second day the chief of Shumopovi, Naeihiptewa, went to the camp of the workmen and forbade them to continue the work. It seems that the chiefs of the three villages, Mishongnovi, Shipaulovi, and Shumopovi, had assembled in council on the night of the author's arrival and decided that his work should not go on. For some reason they had not communicated their wishes to the author, but went directly to the Indians, working on their feelings and threatening them with trouble if they continued excavating. As soon as the author learned of the objection he immediately called a council of the chiefs at his camp, and learned from Naeihiptewa that he did not wish the work to go on, fearing that it would cause great winds which would drive away the rain clouds. The author respected his wishes and ceased work at Shumopovi, discharging his workmen. Had he been able to complete the work at this ruin there is little doubt that over a thousand bowls could have been taken from the burial places of that ancient pueblo.

It would appear from the examination of the Shumopovi cemeteries that they were distributed among the foothills east of the main spring of the present town. From the quantities of broken pottery in this region, it is evident that their extent was very considerable. In some instances burial places were separated a considerable distance from the ruins of the pueblo, in others they were quite near the foundation of the walls.

A small cemetery was discovered about a quarter of a mile east of the ruins, where there is a patch of sand in which grow a few dwarf peach trees. The author camped at this point, which was as near as he could approach the ruin with his wagon, and immediately after his arrival a family of Shumopovi people came down from the mesa and began to hoe the squash plants which grew there—an act which was interpreted to mean possession. The Snake chief of Shumopovi had a brush house, called a kisi, overlooking his farm, on a small hillock near this burial place.

The ancient pueblo can be traced for several hundred feet, but its old walls have been buried or leveled, and very few evidences of its architectural plan can be made out by superficial studies. The mounds of the old site are covered with fragments of pottery of the finest character, beautifully ornamented,^a with the characteristic Sikyatki symbol

POTTERY FROM THE RUINS

GENERAL FEATURES AND FORM

A superficial examination of the pottery of this old pueblo shows what a more intimate study demonstrates—that it is very similar to that from ruins near the East mesa, and that it differs from that of the Little Colorado pueblos. The majority of the pieces belong to the fine yellow ware (plates XLVIII, L), smoothly polished and elaborately decorated. There are a few examples of red and black ware and one or two specimens of black and white ware (plate XLIX), but the yellow ware predominates, as it does at Sikyatki. This is undoubtedly due to the chemical constituents of the clay used in its manufacture. There are no specimens of red, black, and white ware, and no black and no glazed varieties.

The resemblance, which amounts almost to an identity, in the character of the pottery of Sikyatki and Old Shumopovi, as well as the similarity in the symbolism, adds weight to the belief that these pueblos were inhabited synchronously.

There is no essential difference in the shapes of the pottery from this ruin and of that from the pueblos on the Little Colorado, where food bowls, vases, jars, ladles, and dippers are represented. In plate LI two of the best specimens are figured, but there are many others in the collection of equal beauty which have not been reproduced.

There were two specimens of food bowls from Shumopovi with snouts, one of which is shown in the accompanying cut (figure 68). This form appears to be rare, and has not yet been found in the ruins along the Little Colorado river.

^a A very fine collection of mortuary pottery was made at Shumopovi by Mr T. V. Keam, after the author was obliged to abandon work there. Many of these pieces are now in the Field Columbian Museum at Chicago, which purchased the collection.

DECORATION

The picture writing on Shumopovi ware closely resembles that on the ware of the ruins near the East mesa, and though from the limited examination which was possible on account of the size of the collection



FIG. 68. Bowl with snout, from Shumopovi (number 157817).

few new forms were found, the author is able to add some instructive pictures to those already known from this region. On the whole, Old Shumopovi pictography is like that of Sikyatki and Awatobi, and differs from that of Homolobi. The geometrical figures do not widely



FIG. 69. Plumed Snake. Design on food bowl from Shumopovi (number 157769).

differ from those of other pueblo regions in Arizona north of the Mogollones, and are of the same type as those of Chaves pass, Cheylon, and Homolobi.

Plate LI shows the face of a masked dancer, the treatment of the left eye of which resembles that of this organ in certain Zuñi masks.

The only figure of a reptile which was found at Shumopovi was drawn on the inside of a food bowl (see figure 69). This figure is so different from any representation of the Plumed Snake that the author has hesitated to refer it to this mythic being. The feathers on the head, if such they be, are two semicircular bodies, and the tongue is represented by a line with arrowpoint termination. The eyes are both on one side of the head, and the lines on the head and body are incised, making designs which are highly successful from a decorative point of view. The bowl is a small one, and is made of the fine yellow ware characteristic of ancient Tusayan ruins.

An examination of bird figures from Shumopovi shows a marked



FIG. 70. Mythic bird and game of chance. Design on food bowl from Shumopovi (number 157714).

difference from those of the ruins on the Little Colorado and a close likeness to those of Sikyatki and other ruins near the East mesa. Specimens were found with the peculiar conventionalized form of the "breath feather" so constant in the collections made in 1895, and there were fine specimens of the sky band and the dependent bird. The design represented on the food bowl shown in figure 70 is very instructive. From a comparison with other figures of Kwataka the author is led to refer this figure to the mythic bird-man god. The head represented in profile has two triangular feathers, and on the throat and breast appear the terraced designs so often found in bird symbols. The feathers of the wing are triangular. There are reasons of a comparative nature which lead the author to believe that the band on which the bird rests represents the sky band, and the ring represents

either the earth or the sun. The position of the three tail feathers in this drawing is thoroughly characteristic of ancient pueblo art. Instead of being drawn in a horizontal plane, as they naturally would be in a side view of the bird, they appear in a vertical plane, as often occurs in these figures. This characteristic arrangement of the tail feathers is common in the decoration of modern vases from Acoma, where the bird is a constant ornament. It may also be seen in the avian figures which decorate many of the ancient bowls, vases, and jars from Sikyatki and Awatobi. The terraced figures on the under side of the head are of frequent occurrence in bird designs. The three cross lines occur on several Sikyatki bowls and represent stars.

The design on the food bowl from the ruin of old Shumopovi, shown in figure 71, represents a bird god, as is shown by the three tail feathers

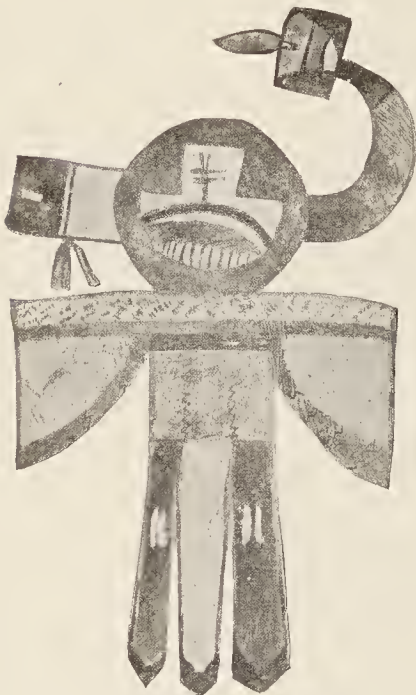


FIG. 71. Bird design on food bowl from Shumopovi (number 157795).

and the triangular wings. The head takes the form and bears the symbolism of that of a masked kateina still personated in Tusayan. The horn on the left side of the head terminates in a conventional figure of a feather, and the design on the right-hand side is a symbol of the squash flower. On the face is the terraced symbol of a rain cloud, still used in modern Hopi symbolism and very common in ancient bird figures. Within this terraced figure are represented the dragon fly, rainbow, and falling rain. It will be noticed that each of the two exterior tail feathers bears two smaller white lines. Similar symbols characterize the figures of the war god, and are said to indicate the hawk. There are legends extant that these are markings made by the claws of some animal in its struggles. They are

found on the cheeks of idols of the war god in several pueblos, as Sia, Zuñi, and those of Tusayan.

The avian figure on the food bowl shown in figure 72 represents a raptorial bird with extended wing. The homology of the two long bodies dependent from the breast is apparent when we compare them with the symbolic feather on Sikyatki pottery. They represent the breast feathers of the eagle; the symbol is still preserved in modern Hopi ceramics, but, so far as is known, has not yet been found on pottery from the Little Colorado ruins.

Both eyes are represented on one side of the head, and the beak is

curved like that of raptorial birds, which are so common in the decoration of Homolobi ware. This figure also shows a very common vio-



FIG. 72. Mythic bird design on food bowl from Shumopovi (number 157134).

lation of perspective among ancient and modern Hopi artists, for the tail feathers are turned from the natural horizontal to a vertical plane.

The design shown in figure 73 represents a bird in which the curved

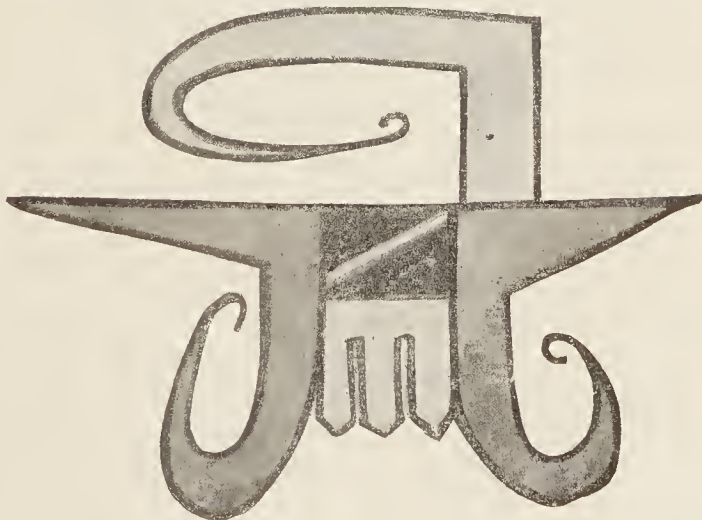


FIG. 73. Symbolic bird design on food bowl from Shumopovi (number 157771).

body above is the head, the two lateral triangles the wings, and the three pointed bodies the three tail feathers. The two curved bodies,

one on each side of the tail, are backward extensions of the bodies which assume different forms in as many different representations.

This is a form of bird symbolism unknown in pictography from the Little Colorado ruins, but very common, in many variations, at Sikyatki. Its reduction to bird symbolism may be readily followed by a comparison with the series given in the report on the field work of 1895.^a



FIG. 74. Gambling canes and bird. Design on food bowl from Shumopovi (number 157735).

The food bowl shown in figure 74 is a beautiful specimen of yellow ware, decorated on the interior with two figures, one representing a bird and the other four canes used in a game still played in modern pueblos. The bird figure evidently represents the Heart-of-the-sky god, whose symbol is a star, which is represented on the head of this divinity in designs from Sikyatki figured in the account of the expedition of 1895. The wings and tail feathers, three in number, are easily recognized.

The four gaming canes are marked in different ways, and correspond with the four cardinal points. Their markings are, however,

^aSeventeenth Annual Report of the Bureau of American Ethnology, pt. 2, 1898.

different from those on a set of these canes taken from the ruin at the mouth of the Cheylon fork, to which reference has already been made.

These canes, corresponding in a general way with those used in Zuñi in the game toshalewa, are rarely employed at the East mesa, but the occurrence of figures of them in old Tusayan ruins indicates the age of this game in the pueblo area. While the markings on these objects are not the same as those on the Zuñi, the variations are no greater than would be expected, considering the ruin in which they were found. The general character of the game was evidently very similar.

SUMMER OF 1897

INTRODUCTION

In continuation of the field work in Arizona in 1896, the results of which have been given in the preceding pages, the author again visited this Territory in 1897, remaining about three months, from June 25 to September 30.

He was accompanied, as in 1896, by Dr Walter Hough, of the National Museum, who rendered most valuable aid, and also by Mr F. W. Hodge, of the Bureau of American Ethnology, who joined the party at the close of July, remaining with it during the visit to the Hopi Snake dances in the following month.

He was aided also by Mr Frank Zuck, of Holbrook, Arizona, and a number of young men from Taylor and Snowflake who were employed at Four-mile ruin as laborers. In the Pueblo Viejo Mexican workmen were relied on, all of whom performed their duties very satisfactorily.

The collection obtained in 1897 was smaller than that made in previous years, but it was more varied and more instructive in its bearings on questions of the migrations of the prehistoric people of Arizona than any other thus far made. The ethnological side of the work was not neglected. Dr Hough continued his studies of ethnology inaugurated in the previous years, and has already published the new material obtained by him in the *American Anthropologist*.^a

As the author visited Tusayan at the time of the Snake dances, he made new observations of the Mishongnovi variant of this ceremony. A record of his studies of this subject is found in the Nineteenth Annual Report of the Bureau of American Ethnology, with accounts of the Flute dance at the same pueblo, compiled from notes made in 1896.

On his return from the Southwest the author prepared a preliminary account of the archeological work, and it was published with illustrations in the Smithsonian Report for 1897. This account was limited, and contains only the more salient results of the work. The present report is intended to be more complete, but is by no means exhaustive.

The primary aim of the expedition was the collecting of specimens. To accomplish this the author was obliged, because of limited forces, to spend much of his energy, to the neglect of other lines of investi-

gation. The collections of 1897 number a few short of 1,000 entries in the catalog of the National Museum. In gathering this material the greatest care was taken to label it properly. Neglect of this obvious duty has destroyed much of the intrinsic value of many collections, and has led to errors in conclusions which might readily have been avoided.

The present report completes the record of notes and other data bearing on the collections made in the three years during which the author has had the honor to direct field work in the Southwest for the Smithsonian Institution. There are many obscure points touched upon which would be greatly illuminated were it possible to continue this line of investigation. So closely connected, however, are the archeological and ethnological problems of the Southwest that the former can not be exhaustively treated while the latter are so imperfectly solved.

PLAN OF THE EXPEDITION

The summer's field work of 1896 verified by archeological evidences the truth of the statements of the Hopis that some of their clans once lived at Homolobi on the banks of the Little Colorado, not far from Winslow, Arizona. It was desirable to study several other ruins on this river or its tributaries, and to compare objects indicative of the culture of their ancient people with those of this undoubted home of early Hopi clans. The author therefore examined ruins near Pinedale, on a small southern tributary of this stream near its source in the foothills of the White mountains. While employed at this ruin he heard of an extensive, undescribed ruin near the Mormon town Snowflake, situated on the same stream as Pinedale, but farther north. These ruins at Pinedale and Snowflake are almost on the meridian of modern Walpi and the mouth of the San Pedro river in the Gila valley.

There is historical evidence that at one time the Hopis used a southern trail from their pueblo to the Gila, penetrating to the rancherias of the San Pedro, and that this trail was rendered impassable by the incursions of hostile Apaches in comparatively late historical times. An examination of old pueblos situated on or near this trail was believed to have considerable importance in connection with legends and with historical evidences that it was used by pueblo peoples.

Having studied the archeology of the ruins on southern tributaries of the Little Colorado, the author made his way south of the White mountains to that part of the Gila valley which is locally known as Pueblo Viejo, an archeologically uninvestigated region which was formerly densely populated and extensively farmed. He desired to discover the relationship of the former people of this valley with those of the Little Colorado, as well as with those of the Gila and Salado rivers, near Tempe and Phoenix. He likewise wished to

trace the similarities, if any, of the art remains of these ancient farmers with those of peoples who once lived on the Little Colorado and its southern tributaries—what resemblances there were in implements, pottery, and other art products, and what likeness in manners and customs, as indicated by archeological data.

One of the most important objects of the expedition was to add to the sum of available paleogeographical material from different sections of the valley drained by the Little Colorado river. Although the amount of this material now in museums is large, an increase of it was considered desirable. It has been pointed out elsewhere that pictures on old pottery are objective expressions of religious symbolism, and that they should be treated as such. Each ruin has its characteristic designs, and there are features peculiar to certain localities. An interpretation of this highly interesting pictography can be facilitated by the discovery of new pictures, and the more numerous the localities from which it is obtained the more important will be its teaching. A discovery of the geographical limits of the same symbolism is important, and its connection with the migration of certain clans is significant.

The influence of environment on ancient pottery is a subject of no less interest than that of its symbolism. As we pass, in the Southwest, from one locality to another, the ingredients of the clay from which pottery is made change, and the action of fire upon these components leads to modifications in their colors when they are used in decoration. It would be instructive to follow these changes in their many modifications and determine what relations exist between the distribution of various clays and different colored pottery. This would require a collection of ceramic wares from many localities. We can rely only in part on classifications of pottery based on colors as indicative of kinship. People of different stocks make pottery of the same colors when they use the same or similar clays. Decorations of the same kind, or an identical symbolism, are a much more trustworthy basis of classification, although not always reliable.

The ruins studied in 1897 were chosen with a view of obtaining comparative data concerning pottery and its decoration from localities in different latitudes of Arizona as nearly as possible on the same meridian as those studied in previous years.

The investigations at Kintiel were especially directed toward the future plotting of an archeological meridian through Zuñi as a basis of comparison with the Tusayan zone, in which Walpi is situated.

It is possible for the expert student of modern pueblo pottery to determine at a glance the pueblo in which any piece was made. Thus, no specialist would mistake a Zuñi vase for one from Acoma or confound a Tusayan food bowl with one from Laguna or Santa Clara. This exact knowledge has become possible from the fact that our museums are rich in modern ware and familiarity with its char-

acteristics is possible; but an ability to identify modern pueblo pottery by its symbolism is of little help in the determination of ancient ware from the several localities. To determine whether an ancient vessel came from near Zuñi or from the neighborhood of Walpi we must study typical collections of ancient ware. From investigations thus far conducted the author is able to distinguish ancient Hopi from ancient Zuñi pottery, but the geographical limits of each are unknown to him and he is wholly unable to distinguish ancient Jemez ware from that of Acoma, Sia, or Cochiti. For a provisional classification the author has divided the pueblo area into a number of parallel zones extending north and south. Tusayan lies in one of these zones, Kintiel and Zuñi in another. Whatever zones it may be necessary to make to facilitate the study of ancient pottery of the eastern pueblos does not concern the present report, but it is worthy of note that thus far ancient material from them is so limited that even a provisional determination of these areas is premature.

The author has collected no legends of the Hopi Indians which refer in any way to the ruins excavated in 1897, and he believes it is to the Zuñis rather than to the Hopis that we should look for traditional accounts of them which may still survive. Nor has he found any historical reference to old houses on the Little Colorado river, although Four-mile ruin is situated west of Zuñi, and may have been one of the pueblos of the Cipias, a sedentary tribe mentioned by Spanish writers in the seventeenth century. Though this name is said still to survive in Zuñi legends, the author has thus far failed to elicit any information in Hopi stories regarding the ancient Cipias^a (see page 23).

The pueblos in the region south of Holbrook are too far east to be referred to the Patki and other clans which claim Homolobi as their former home; and their surroundings do not in any way agree with the current Hopi account of Palatkwabi, the "Old Red land," or the "Giant Cactus country." It is always to the mountains south of Winslow that the old men of the Patki clan point when they tell of the place of origin of their forefathers. It is instructive to remember that the invasion of the Apaches, directed against the modern Hopi pueblos, was always from the south, while that of the Utes was from the north. The earliest historical account of the contact of the Apaches with the Hopis indicates that these Athapasean nomads shut the latter off from their southern kindred by occupying the trails to the Gila and causing Homolobi to be abandoned, and then pressed north against the modern towns.

^aThe Hopi name of the modern pueblo Isleta is Teipiya.

KINTIEL

THE RUIN AND ITS CEMETERIES

Up to within a few years, especially since the American occupation, a ruin called Pueblo Grande has been designated on most maps of Arizona and New Mexico. This pueblo lies about 25 miles north of the railroad station of Navajo, and ten years ago it was one of the best ruins of the Southwest, approaching in the perfection of preservation the famous ruins of the Chaco canyon. To the Navahos who range that region the ruin is known as Kintiel, or Broad house. On the author's first visit to it, ten years ago, the walls stood higher than a man's head, and the rooms were probably in about the condition in which they were shortly after its abandonment. At present very little of the ancient walls remains, for they have been torn down by a trader, who has used the stones of which they were made in building a house and store in about the center of the ruin. In fact, where the foundations of the walls of this fine ruin once stood, nothing now remains but a trench, for the lower courses of stones, being the largest, were sought out for building material in preference to the smaller stones which were placed upon them.

The documentary history of Kintiel is a short chapter. Early Spanish accounts do not mention the place, and the Spanish name Pueblo Grande appears only on later maps of the country. There is said, however, to be a legend concerning it among the present Zuñis, which is mentioned in the Fourth Annual Report of the director of the Bureau of American Ethnology (1883):

Pending the arrival of goods at Moki, he [Mr Cushing] returned across the country to Zuñi, a measure . . . enabling him to observe more minutely than on former occasions the annual sun ceremonial. En route he discovered two ruins, apparently before unvisited, both, according to Zuñi tradition, belonging to the Hlé-etákwe, or the northwestern migration of the Bear, Crane, Frog, Deer, Yellow-wood, and other gentes of the ancestral pueblo. One of these was the outlying structure of K'in'ik'el, called by the Navajo Zinnijännë and by the Zuñi Héshotapáthltäë.

It is interesting to note that all the above-mentioned Zuñi clans have or had representatives in the Hopi pueblos, and that at least three of them, viz, Bear, Deer, and Yellow-wood, which is probably the Hopi Kokop clan, are reputed by the Walpi traditionalists to have come into Tusayan from the East. Whether or not these families of eastern origin are descendants from Kintiel people is impossible to say, on account of the author's unfamiliarity with the migration legends of these particular clans. It is instructive to learn that with the exception possibly of the Frog clan no Patki or Rain-cloud people have yet been mentioned from Kintiel, nor do any of the traditions of the Patki people mention Kintiel as their former home.

No further mention of these ruins is known to the author until the description by Victor Mindeleff, in his very important account of Tusayan and Cibolan architecture, published in the Eighth Annual Report of the Bureau of American Ethnology.

Fortunately for science, Mr Cosmos Mindeleff camped at Kintiel ruin before its destruction and made excellent photographs and plans of the ruin. He likewise conducted limited excavations, which were later recorded in a report of the Bureau of American Ethnology.

Recognizing, on his arrival at Kintiel, that it would be impossible to add much to what had been recorded in regard to a ruin so mutilated as Kintiel now is, the author naturally sought to learn what he could from excavations. The results were somewhat disappointing, and, as compared with the collections made at other ruins, only a few specimens were obtained from this large pueblo.

There is one feature in the architecture of the walls of Kintiel which seems worthy of special notice, a feature which Nordenskiöld recognized in Mesa Verde ruins, and which the author has described in the round house near Montzeimer's ranch,^a viz, the difference in size of the building stones in the walls and foundations. The largest stones occur at the base, or in the lower courses, the smaller in the more elevated portions of the walls. This arrangement has a wide distribution in other parts of the Southwest.

The nearest point on the railroad to Kintiel is the station Navajo, from which there is a good road to the ruin. This road passes in sight of several small mounds with indications of former houses, and not far from Navajo station there are several ruins, some of considerable size, but all in a poor state of preservation. All of these are here referred to Zuñi rather than Hopi clans, for the fragments of pottery which were collected on them resemble the pottery of ancient Zuñi ruins.

The exact lines of demarcation between ancient Zuñi and Hopi ruined pueblos will probably be impossible to find, mainly because there is little doubt that the distinctive features between Zuñi and Walpi, so marked in modern times, did not exist in ancient times. Clans from certain pueblos now in ruins in this region sought union with the population of Zuñi; others went to modern Tusayan and were incorporated into the population of the villages there. Other families drifted out of Zuñi and founded pueblos of their own or halted in their migration from Cibola to Tusayan and erected pueblos which were abandoned after a few years or generations.

Kintiel may be classified as a circular ruin (see plate LIII). This form is unlike that of any Tusayan ruin, with possibly the exception of the two mounds called Kükütcomo, above Sikyatki. Round ruins are foreign to the Hopi country and are absent from all the portion of Arizona south of the present inhabited pueblos of the Hopi reser-

^a *Journal of American Ethnology and Archaeology*, v. 1, 1891, p. 127.

vation. The same may be said of round rooms or kivas. When, however, we enter the Zuñi belt, which extends from the San Juan and Mancos canyon cliff houses south through Zuñi, we find both circular and rectangular ruins, with circular rooms especially noticeable in the cliff houses. Kintiel is one of these, and architecturally, therefore, belongs to the Zuñi series, as its geographical position and pottery clearly indicate.

Kintiel is not, however, perfectly round, but is broader than long, assuming a shape comparable with that of a moth with extended wings. The two sides were built on sloping land, and between them there runs a depression corresponding to the body of the insect of our comparison. This median depression is at right angles to the broadest part of the ruin, and in it is the spring which furnished the water supply. The present occupant of the ruin, an Indian trader, has erected his buildings within the inclosure of the ruin near this depression, and has dug out the ancient spring, which furnishes abundant water for his purposes. In excavating this spring he found the inclosing walls still intact, with a flight of stone steps by which the ancients once descended to the water. Notwithstanding sanitary objections to such a position for the spring, especially when the population of the surrounding houses was large, from a defensive point of view it was perfect. The violation of sanitary laws among the modern pueblo peoples implies that among the ancients there was little regard paid to health in the choice of a water supply, and little care in keeping the water pure.

Extensive excavations at Kintiel revealed a cemetery on the eastern side of the northern section. The burials were made close up to the outer walls of the buildings, as at Homolobi, but no uniformity in the orientation of the bodies was noted. No undoubted evidences of cremation were detected, and all skeletons exhumed were from suburban cemeteries. A limited number of specimens of mortuary pottery was obtained in the neighborhood of these skeletons. Many of these specimens were broken, but others were whole and in good condition.

The author is inclined to regard Kintiel as a comparatively modern pueblo, one of many which were founded later than the earliest Spanish invasions. One reason which led to this conclusion is the fine preservation of the buildings. Up to within a decade they had not the appearance of antiquity which old ruins always show, nor are there now any large refuse heaps or pottery burning places, which so often indicate great age, about it. The few graves in the cemeteries and the distance apart of those which do exist may be regarded as negative evidence of limited value, for it may be said that we may not have happened upon the populous graveyards. Yet much more earth was moved in the excavations than at Homolobi, and only a tenth as many interments were brought to light, and the natural inference is that the pueblo was not old. Nothing, however, indicative of white men's

influence was found in the ruin. Although it may have been inhabited since the discovery of Arizona, there is no evidence that Spaniard or American ever visited it while inhabited.

There is a close resemblance between Kintiel, as it was ten years ago, and the Pueblo Bonito and other great houses of the Chaco canyon, and from its general appearance as compared with these the author believes that it is of about the same age.

There is a Navaho tradition that at least one of the Chaco ruins was built by Zuñi clans, which would indicate a reason for the similarity in the construction of Kintiel or Pueblo Grande and its namesake in the above canyon.^a Kintiel also resembles architecturally the well-preserved Zuñi ruins at Archeotekopa, which is described elsewhere,^b but we need much more information about these interesting ruins, especially about their pottery and the Zuñi legends concerning them, before it is possible to form any trustworthy conclusions.

Kintiel is situated on the Leroux wash,^c which flows north of Holbrook, and turning south empties into the Little Colorado west of the town. The wagon road goes from Holbrook past the X ranch up the wash to the ruin of Kintiel. There is a ruin of some size at Tanner's spring, from which place the author has seen several fine specimens of pottery. As these fragments closely resemble the Kintiel pottery, it is probable that the ruins belonged to the same or to closely related people.

There is also a ruin of some size near Hubbell's store, at the Pueblo Granado, about the same distance north of Kintiel that Navajo station is south of it. Pottery from this ruin is ancient, much older than that from Kintiel. West of this ruin, at Eighteen-mile spring, there is a circular ruin which must also be referred to the Zuñi belt. The author has been told that there is a Spanish inscription of the seventeenth century not far from this spring, but he has never seen it.

The number of rooms at Kintiel would lead to the belief that the population was large, certainly reaching into the hundreds. There were evidently several clans living there, and at the lowest estimate we are justified in believing that 300 people found shelter within its walls. Probably the population was nearer 500 souls, or about the same number that formerly lived at Sikyatki.

A small stone inclosure, apparently a shrine, was found a few feet from the outer wall of Kintiel, on the south side. Its contents were carefully gathered together and added to the collection. The objects found in this inclosure consisted of a number of curiously formed stones and concretions, any one of which might, from its odd shape, be regarded as a fetish. Several of these stones were rudely worked into

^aThe name Kintiel, or Broad House, is applied by the Navahos to at least two circular pueblo ruins in the Southwest. One of these is in the Chaco canyon, and is said also to have been constructed by the Zuñis.

^bJournal of American Ethnology and Archaeology, v. 1, 1891, p. 122.

^cNamed from the famous guide and trapper Leroux, whose knowledge of the Southwest was of such great value to early explorations in this region.

animal shapes, with head, eyes, and mouth represented. Similar collections of stones are common near the approaches to the modern Hopi towns and are ordinarily called shrines of the god of death, Masauû. It is customary for a Hopi Indian, on approaching the pueblo, to throw on these piles any small stone he may have found, and in much the same way, no doubt, the pile of stones found at Kintiel was formed, for this same custom of casting stones in a pile exists at Zuñi, the pueblo to whose people those of Kintiel were allied.

Just south of the two standing sections of wall there was a cluster of stone cysts, probably ancient ovens. They varied in size from 1 foot or 2 feet square to larger dimensions—6 by 3 feet. Charred wood and ashes were found in some of these, and the bounding stones showed the action of fire. These structures reminded one of the suburban, communal ovens, which have been described^a in the Zuñi ruin, Heshotauthla. The communal ovens at the latter ruin, like those at Kintiel, are situated just outside the walls of the pueblo, but unlike them they are, as a rule, round, and of equal size. It would appear that cooking was done in these ovens rather than in the dwelling houses. The Hopi food called pikame, made for ceremonial feasts, is still cooked outside the dwellings, and the Zuñis likewise have ovens separated from their houses, as is common in Mexican towns in the Southwest.

The cemeteries east of Kintiel revealed many skeletons in fair preservation, and it was noticed that those near the surface were mostly of infants, the adults, as a rule, being found deeper. The first skeleton excavated was that of an infant buried under a flat stone 2 feet below the surface. The grave had mortuary objects in the form of a few miniature rough bowls and a small jar of coiled ware. As the excavations penetrated deeper, there were found many fragments of pottery, broken ladle handles, ashes, and other indications that this was the dump place of the neighboring pueblo, the outer wall of which was 50 feet away.

One of the most instructive burials at Kintiel was found in the east cemetery. This was interpreted as a secondary interment. It consisted of human bones stripped of flesh and deposited in the earth with customary mortuary vessels. The reason for the belief that these bones were not covered with flesh when the bowls were placed upon them is that their position was not that which they would have had if articulated. The femurs were placed in the reverse of the natural position, and a humerus was found crossing the femur. No skull or pelvis was found in the grave. A flat earthen disk was luted to the neck of a vase placed on the bones, and there was a food bowl near by.

^aJournal of American Ethnology and Archaeology, vol. 1, 1891, p. 133.

POTTERY FROM THE RUIN

GENERAL FEATURES AND FORM

The pottery from this ruin belongs essentially to the Zuñi type, and is very different from that of the Tusayan series. It is, as a rule, of coarse texture, and decorated with rude symbols. We miss in it the fine yellow ware for which Tusayan is famous, and find in its place abundant red pottery, with a comparatively large proportion of black and white. The decorative designs are mainly geometrical, and picture writing is very limited in quantity. The decoration is essentially different from that of Sikyatki, and resembles closely that of Heshotauthla and Halona, two ruins near Zuñi pueblo.

The greater the number of ancient Zuñi pottery objects which were examined, the stronger became the belief that the ancient potters of this region were inferior to the ancient Hopis in their ceramic productions. Modern Zuñi ware is certainly as fine as modern Hopi, and, a priori, the author sees no reason why the older pottery of one region should be inferior to that of the other. He formerly supposed that this inferiority was due mainly to imperfect collections and that the best examples of ancient Zuñi ware were still under ground, so that the known specimens gave an imperfect idea of what other and larger collections might reveal.

While these earlier conclusions may be verified by later studies, the author now inclines to the belief that the Zuñis never advanced to the same perfection in the ceramic art as did the Hopis. It must be confessed, however, that pottery has been taken from the cliff houses north of Zuñi which is as fine as the Tusayan ware, and if this excellent pottery is classified as Zuñi ware, an unfavorable criticism is not just. So far as texture is concerned, the Tusayan ware is superior to all others in the Southwest, with the exception of the black and white ware of cliff dwellers. In the character of designs the superiority is even greater. In the evolution of Pueblo decoration the development of ornamentation advances from geometrical patterns to rude picture writing, and, as a rule, the pottery on which the former predominate is inferior to that on which the latter is most prominent. Not that we should regard this a hard and fast law without exception; the cleverest potters often adorn their wares with simplest patterns; but in a ruin where most of the pottery is decorated with geometrical figures, and the few existing pictures of animals—as birds, reptiles, or human beings—are rudely made, the artistic development is inferior to that where the conditions are reversed.

Judged by the criterion of designs, Tusayan decoration of ceramic ware shows a superiority over all others in the pueblo area, as anyone will confess who impartially examines large collections from different areas of the Southwest.

It would appear, too, that this high development was autochthonous,

and originated within the limited area in the midst of which the present Hopi villages are situated, where not only the decoration, but also the ware itself is superior. Strangely enough, the more ancient the ruin is, the better is the pottery. This may have a bearing on certain theories regarding the ancestors of the Hopis, for we have been accustomed to hear them spoken of as rude Shoshoneans

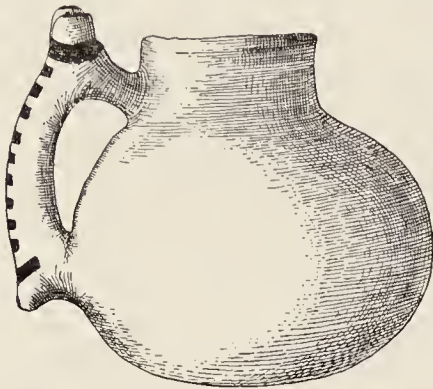


FIG. 75. Dipper with decorated handle, from Kintiel.

akin to some of the lowest tribes of the Rocky mountains, who have adopted a pueblo life after they came into the pueblo area. The author's researches show that only a small part of them claim to have sprung from the north, but from whatever source they came, and whether they adopted the pueblo life after their arrival or not, they reached a higher culture, judged by artistic excellence of pottery, than any other pueblo people.

Some of the specimens of coiled ware from Kintiel are remarkably fine. One of the best is almost black, as though discolored by constant use in the fire, and was evidently a cooking pot.

The accompanying figure (75) of a dipper from Kintiel might readily be mistaken for a like object from the cliff houses of the Mancos canyon. It is a common form of black and white ware almost universal throughout the Southwest.

The forms of pottery from Kintiel are not exceptional, for all the types which were found there occur elsewhere. The rough ware, universal in the pueblo area, is abundant in the Kintiel graves, and leads all others in number of specimens (see figure 76). This is in marked contrast to collections from Sikyatki and the Little Colorado ruins, where smooth decorated ware predominated.



FIG. 76. Coiled vase from Kintiel (number 176910).

There were comparatively few food vessels, and no large vases were obtained. Cups, ladles, vases, and slipper jars were the most common pottery forms. A three-lobed cup of red ware was dug out of the eastern cemetery. This form is exceptional in the pueblo ruins which the author had previously examined, but beautiful specimens have been found at Homolobi and Cheylon.

The amphora form of globular vessel is rare in Southwestern ruins, but is represented by a single specimen (figure 77) from Kintiel. This vessel is of black and white ware, and the design on the equatorial region is characteristic.

A very good specimen of globular form (figure 78) was found at Kintiel. This was made of black and white ware, and is one of the finest specimens in the collection.

All these examples are white ware decorated with figures in black, and the white is a slip rubbed over coarser clay. In firing, since the contraction and expansion of this



FIG. 77. Two-handled bowl from Kintiel (number 176936).



FIG. 78. Globular bowl from Kintiel.

slip is not the same as that of the base on which it is laid, we find a crackled surface unknown in true ancient Hopi pottery.

Many of the ladle handles were perforated with rows of holes; several were decorated with alternate parallel and longitudinal bands, a type of ornamentation which is found as far south as the northern border of Old Mexico and has been recorded from Mexican ruins in Chihuahua.

Several fragments of the necks of vases with pits or depressions were found. Some of these pits resembled small cups, but the author believes the depressions are finger holds, by which the vessel was carried. Fragments with similar depressions are found elsewhere in the Southwestern ruins, and there are one or two complete vases with the same finger holds, in which there can be no doubt of their use.

DECORATION

The limited number of specimens of pottery from the ruin makes it necessary to speak of this aspect of the subject in a very general way.

There is little similarity of picture design between these specimens and those of modern Zuñi which have been examined, save in geometrical patterns; so that the author is led to suggest a theory to account for this fact, similar to that which he has elsewhere advanced to explain the change in symbolism in Hopi pottery. The differences



FIG. 79. Handle of dipper from Kintiel.

between modern and ancient Hopi ceramic designs are due to the advent of new clans as colonists, for these new arrivals introduced their strange cults, of which, up to that time, the Hopis were ignorant.

Possibly a similar explanation may account for some of the designs on modern Zuñi pottery. Modern vessels from these two regions bear, however, widely different decorations. The many likenesses between ancient Zuñi ware and that of Kintiel are the main reasons for his association of the two, but these similarities are mainly in geometrical patterns.



FIG. 80. Frog design on bowl from Kintiel.

One or two specimens of pottery from Kintiel had handles decorated with the forms of animals, and one of these, of black and white ware, was particularly well made (see figure 79). The intention was evidently to represent some many-legged animal, combining painting with sculpture.

A knob on one vase has been identified as a representation of the head of an antelope. This is an unusual form of decoration.

The modification of the handle of a dipper into an animal form is not rare in ancient pueblo pottery, and the author has seen specimens in which a mammal, possibly a bear, was represented in that way. In modern pueblo pottery, animal forms are very common, and they are especially abundant in modern Zuñi ware, as an examination of the rich collection in the National Museum will demonstrate. This method of ornamentation is not very common in pottery from ancient or modern Hopi towns, though the Hopi priests called "mudheads" or "clowns" are often represented on the handles of ladles, and in the large collections from Sikyatki not a single specimen adorned in this manner can be found.



FIG. 81. Food bowl from Kintiel.



FIG. 82. Bird design on food bowl from Kintiel.

One of the vessels from Kintiel was decorated on the interior with what seems to be a figure of a lizard or tailed batrachian (see figure 80). The design is simple, and is not unlike figures which are found as pictographs in the Canyon de Chelly and elsewhere in the Southwest.

The decoration on the exterior of the food basin shown in figure 81 is highly characteristic and markedly different from that on Sikyatki pottery. In this specimen the design on the exterior consists of a number of interlocked S-shaped figures, which are likewise found on the pottery of the Little Colorado ruins. The external decorations on the food basins from Sikyatki are, as a rule, rectilinear, and curved figures are rare or unknown. A very much mutilated figure of a bird which decorates a bowl is shown in figure 82.

The accompanying illustration (figure 83) gives a good idea of a Kintiel mug of black and white ware and the calcareous incrustation with which the majority of these ancient vessels was covered. This mug is decorated with geometrical patterns, the nature of which may be seen in the illustration. Like many others from Kintiel, it was covered with a calcareous deposit, which can readily be removed by washing.



FIG. 83. Cup from Kintiel (number 176811).

One of the best specimens of white ware from Kintiel is shown in figure 84. The striking feature of this dipper is the form of the handle, which is made in imitation of the head of some animal. There were several specimens of bowls and other vessels with heads of animals, a feature also common in Tusayan ceramics.

MISCELLANEOUS OBJECTS FROM THE RUIN

The stone objects from Kintiel are in no respect peculiar, and consist of mauls, hammers, axes, spearheads, and arrow points.

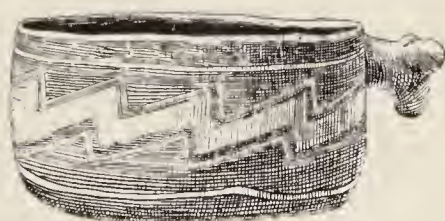


FIG. 84. Dipper from Kintiel.

A small slab of stone had three cavities, arranged in a triangular form, in one surface. There were several clay disks, some with a central hole, others imperforate. Rectangular gorgets of red stone were perforated at one side as if for suspension. There is also a tubular pipe of red stone in the collection.

Symmetrical spherical stone balls, ranging in size from a marble to a baseball, were picked up on the surface.

No prayer sticks were found in the graves, but in one of the food basins there was a collection of several hundred short sections of wood about the size of a small lead pencil, and beveled at both ends. These were about an inch long, reminding one of sticks called the "frog spawn," wooden symbolic objects made in the Walpi Flute and Snake ceremonials.

Bone objects—awls, needles, bodkins, and the like—were numerous. Bone tubes of different sizes were likewise found, and a small bone gouge accompanied one of the skeletons.

Fifteen well-preserved human skulls, excavated from the Kintiel cemetery, were brought to Washington.

KINNA ZINDE

If we compare the Zuñian and Tusayan meridian zones of ruins architecturally, we find that they closely resemble each other, or, if there is any one feature which distinguishes them as groups, it is the predominance in the former of circular ruins. Circular ruins are absent in the Tusayan series, while more than a third of the Zuñi series of ruins are round, oval, circular, or semicircular—rectangular and round combined. The cause of this predominance is unknown, for the explanations which have been advanced to account for round ruins in the Zuñi belt would seem to be equally applicable to the Tusayan belt, where round ruins are absent.

Not far from Kintiel there is a small, well-preserved ancient house called by the Navahos Kinna Zinde. This ruin is in a good state of preservation, the stone walls rising high above the foundations.

As seen from one side Kinna Zinde looks like a round tower, such as are found elsewhere in the Zuñi belt of ruins. A closer examination, however, reveals the fact that only one end of this ruin is round, the remainder being rectangular.

The ruin is situated on a slight elevation overlooking a fertile plain. Flooring indicative of two stories is visible, and the poles of an old ladder by which there was formerly communication from one story to another are still in place. These poles were notched for the insertion of rungs.

The author was struck with the scarcity of pottery fragments and other refuse in the neighborhood, and it was concluded that this building had not been inhabited for any considerable time. It showed no signs of age, and probably was contemporary with Kintiel, which is a few miles away. Kinna Zinde was possibly only a summer farm home, peopled by farmers from Kintiel, comparable with Pescado or Ojo Caliente on the Zuñi reservation. In winter the inhabitants retired to Kintiel, and in summer they used Kinna Zinde as a protected outlook over their farms. Its position was well chosen for this purpose, and it was abandoned at about the same time as Kintiel.

RUINS NEAR HOLBROOK

There are few remains of ancient pueblos near Holbrook, Arizona, and the Hopi trail from that town to Jeditoh valley is not known to pass any considerable ruin. The author has always been astonished that the fine spring at Bitarhütce, the Red cliffs, about 40 miles from Holbrook, on the road to the Hopi towns, appears never to have

furnished water to a neighboring pueblo.^a When the Hopis went back and forth to the Little Colorado, in ancient times, before Holbrook was built, they took the shorter route to Homolobi. That in their communication with Zuñi they did not use this trail to the river is evident, for the Zuñi trail strikes the railroad far to the east.

Both Hopis and Zuñis in their intercommunication used the trail through Kintiel, because there was nothing to invite them any other way. The gateway of modern Tusayan to the southern settlements was past Big and Little Burro springs, from Homolobi, and if we follow that trail we pass many ruins, for the simple reason that it is the ancient route of migration. Pueblo Indians, in their journeys, go from pueblo to pueblo, stopping for entertainment, so wherever we find an ancient trail, there we may expect to find at intervals the ruins of old villages.

OBJECTS FROM WOODRUFF BUTTE

One of the most conspicuous mountains south of Holbrook, visible for some distance along the railroad, is a conical butte called the Pieta mountain or Woodruff butte.

It was not the author's good fortune to visit its summit, but he obtained by purchase a few specimens from that place. The most interesting of these were two small stone fetishes or



FIG. 85. Stone birds from Woodruff butte (number 177898).

bird effigies (see figure 85); there were also some pendants, a few beads, and other ornaments. The bird effigies were very skillfully carved of stone, and were perforated, evidently for suspension. They may have served as fetishes, for they closely resemble similar carved objects which are commonly sold at Zuñi.

ANCIENT HABITATIONS IN THE PETRIFIED FOREST

Learning that there were evidences of ruins in the famous petrified forest of Arizona, near Holbrook, the author made two visits to it and examined a number of ancient mounds within its area. None of the ruins which were seen gave evidence of large size or of a considerable population. Many fragments of pottery resembling ancient Zuñi ware were found, and a few stone implements and metates were picked up on the surface of the ground, but the number was too small to encourage extended excavations in any of the small ruined house clusters which exist in this locality.

An Indian burial was found on the highest point of one of those strange hillocks of the "bad lands" in which the forest is situated,

^a The reader is reminded that this report was written in 1898. Dr Hough's important discoveries in this region were made in 1901 (see Report of the U. S. National Museum for 1901, p. 279-385).

but the skeleton was too poorly preserved to add to the collections. There is a large ruin near Adamana station, and others in the Petrified Forest reservation.

FOUR-MILE RUIN

GENERAL PLAN

This ruin is situated 4 miles from Snowflake, and about 2 miles from Taylor, Arizona, and is one of the largest in the vicinity. It had never been visited prior to the author's work there in 1897, and no specimens from this locality are known besides those which he collected.

The ruin is situated on a bluff overlooking a tributary of the Little



FIG. 86. View of Four-mile ruin from river bed.

Colorado called Pinedale creek. One end of the ancient pueblo overlooks the stream; the other extends along a low crest at right angles to its banks. On the northern and southern sides there are narrow plains, that on the south being apparently composed of alluvium brought down and deposited by the stream, or washed from higher neighboring hills by torrents of rain, which are often very violent in this region. The general form of the ruin is irregularly rectangular, with no well-defined evidences of a central plaza in the western part. The eastern region, however, has a flat top with scattered rooms, and was evidently well situated for ceremonial dances or other gatherings.

The larger population lived in the western part of Four-mile ruin, and probably the eastern region was not permanently inhabited.

In this part of the ancient village there were remnants of circular rows of stones, which suggested shrines, and certain piles of refuse composed in part of ashes, as though remains of fuel used in firing pottery. The eastern quarter of the town does not appear to have had an inclosing wall, and no signs of kivas or ceremonial chambers were detected. It was the only flat place near the pueblo at all suited for sacred dances, and it probably was used for that purpose.

The accompanying cut, figure 86, shows the appearance of Four-mile ruin from the bed of the stream, and gives a fair idea of the bluff upon which the mounds are situated. The north cemetery is situated at the left of the highest point, and the camp of our party is seen at the extreme right.

A ROOM IN THE RUIN

In order to study the architecture of the rooms of Four-mile ruin, earth was removed from one of the best preserved and its dimensions were carefully ascertained. This room had in the past been washed out by torrents of water, and was on that account easy to clear. It was situated on the north side of the highest mound, near the line of separation between east and west portions of the ruin.

The floor was found about 7 feet below the surface. It was paved with large flat stones, nicely fitted to each other, and apparently set in adobe. On the east side there was a raised banquette extending across, and corresponding in a general way with the spectator's section of a Tusayan kiva. It resembled even more closely the raised floor which the author has elsewhere described in the cavate rooms of Verde valley and the cliff-house rooms of the Red Rock country in the same valley.

About midway in the length of the raised portion, near the remaining floor of the room, there was a small crypt or inclosure formed of flat stones set on edge, and similar in form and position to those found in the kivas of the cliff palace of the Mesa Verde. The author has seen a like structure in San Juan pueblo on the upper Rio Grande. In the floor itself there was a depression lined with stone slabs, which may have been a fireplace. The top of the banquette was made of smoothly worn flat stones, and its side was plastered. Several very finely drilled holes penetrated the flags covering the floor and banquette, the arrangement of which is shown in plate LVIII. These were about the same size (that of a broom handle) as the symbolic opening called the sipapû in the floor of a Hopi kiva,^a and when the first one was found the author was inclined to interpret it in the same way. The subsequent discovery of many others left him in doubt as to their proper interpretation.

^a The sipapû of a kiva is symbolic of the opening in the earth through which races, in earliest times, are said to have emerged from the under world.

The structure of the walls was interesting. They were made of adobe, but at regular intervals the much decayed remnants of upright posts were found embedded in them. These posts (figure 87) are thought to be comparable with similar logs used in the construction of the adobe walls of houses in the Gila valley, as described in a subsequent account of the architecture of the buildings of the Pueblo Viejo (page 177). There were no lateral windows in this room, and the entrance was probably from the roof, no remains of which were, however, discovered.

In order to determine the number of superimposed rooms in the highest part of Four-mile ruin, the author followed the walls down



FIG. 87. Upright posts in wall at Four-mile ruin.

from the surface of the main mound, penetrating through two floors before he came to the lowest, which rested on the undisturbed soil. It may, therefore, be concluded that the pueblo in this part had an altitude of three stories, and it is probable that there was still a fourth above, the remains of the walls of which the author was unable to trace. There were no walls standing above the ground at any point on the mounds, and the general appearance of the ruin is that of great age.

As a rule, the oldest ruined pueblos in the open plain are destitute of walls standing above ground: those with high walls are more mod-

ern. This is not a universal law, but it can be relied on with fair certainty. Ruins on hilltops have, as a rule, higher walls above ground than those in the plains, even when they are of equal age. Cliff houses, on account of their sheltered position, preserve their standing walls longer than any other type. No doubt one reason why pueblos of the plain, especially such as those in the valley of the Little Colorado, so seldom have free walls above ground, is their burial by the dense sand storms which sweep over them, especially in the spring months. The destructive rains in time wash through their roofs, and water, making its way into the joints of the upper layers of the walls, causes them to topple over, forming débris at their base. These forces take time, but, except in those ruins which have walls wholly of stone, the most ancient are reduced to simple mounds penetrated by house walls which never rise above the surface of the ground.

SUBURBAN OVENS

In searching for the north cemetery the author began a trench just outside of the bounding wall, and on excavating a few feet below the surface found several eysts like those at Kintiel, which were filled with ashes and charred wood. These are interpreted as suburban ovens. Similar structures were found at Cheylon in 1896, and it is not improbable that they will later be found in many other ruins of the Little Colorado river.

Many authors have referred to the absence of fireplaces in ancient pueblo rooms, and the existence of chimneys in prehistoric times has not yet been proved. The discovery of suburban ovens indicates that cooking was done in the open, just as is the case with certain kinds of food in modern pueblos.

CEMETERIES

It was with considerable difficulty that the author was able to find the burial places of this pueblo, and some time was consumed in the search. In the ruin at Homolobi and on Cheylon creek the interments were discovered just outside the outer walls of the pueblo, and it was natural to look in these places for burials at Four-mile ruin. Extensive trenches failed, however, to reveal any indication of the dead in this part of the mounds. No burials were found close under the walls.

In the course of an examination of the level region some distance north of the mounds, near the river bank, the author unexpectedly discovered a human bone projecting from the soil. This indication was sufficient, and systematic work in the vicinity brought to light many skeletons and mortuary objects.

There can not be a doubt that in the time which has elapsed since the burials were made the stream has encroached upon this ceme-

tery, washing away the superficial soil and leaving a great number of small bowlders. Digging among these stones was very difficult, and many of the burial objects of pottery were broken in extracting them from the earth. This part of the stream bed is not flooded except at times of freshets, and it is covered with a scanty vegetation, composed mainly of small clumps of sage brushes. This vegetation gave indication of the existence of graves, for a skeleton was found under almost every bush, often buried less than a foot below the surface.

A second larger cemetery was found on the opposite side of the ruin at about the same distance from the houses as was the first. The burials at this place were very deep, but the soil was a sandy alluvium in which the pottery was better preserved. As far down as the soil was penetrated skeletons and pottery were found. The greatest difficulty in getting them was due to the caving in of the embankments. Most of the finest specimens were obtained at this point, but the supply was by no means exhausted.

The bodies were buried extended at full length, and with no effort at a common orientation. Most of the skeletons were poorly preserved, even the larger bones crumbling as they were removed from the graves. A number of perfect skulls, including those of adults and children, male and female, were, however, obtained from both cemeteries. No evidence was noticed of an attempt to cover the bodies with logs, as was done at the Chaves pass ruins, or with flat stones, as was so common at Homolobi. No fragment of a wrapping of mats or basketry was found.

A cooking pot found in this cemetery contained a lump of clay, rib bones of some mammal, a stone polisher, and many cedar twigs. Within this bowl were two smaller vessels turned upside down.

Most of the pottery found in the cemeteries of Four-mile ruin was covered with a tenacious, white, calcareous deposit, which was easily removed by washing.

COLLECTIONS

POTTERY

PRINCIPAL TYPES

The pottery of Four-mile ruin is essentially the same as that found at Homolobi and Cheylon in 1896, and consists of about the same proportion of decorated and of rough, coiled ware, the former predominating.

The rough ware differs but little from that of the pueblos already mentioned, but there is a great increase in the number of specimens of this ware with a smooth blackened interior. The percentage of this kind of pottery increases as we go south from the ruins about the inhabited villages of the Hopis, and is greatest in the ruins on the Gila-Salado watershed. The blackened interior resembles the black

ware of Santa Clara pueblo, but no vessel was found at Four-mile ruin whose exterior was of this color.

One of the kinds of rough ware which is well represented at Four-mile ruin is that decorated on the exterior with geometrical patterns (see figure 88). The pigment was applied to the rough outer surface of the coils. Commonly, however, the interior was smooth and blackened, as with certain other rough-ware vessels. The predominating color of pottery from this ruin was red, and almost all forms were made in this color. It is the characteristic color of pottery in the Little Colorado ruins, and is found as far south as Pinedale, reappearing again in the Gila basin.

Bowls of red ware with black decorations having a margin of white occur in many of the Little Colorado ruins. Fine vases of these colors, in which white predominates, especially around the neck, are characteristic of ruins in this valley; the author has found no record of them in the neighborhood of the Hopi towns, or south of the Mogollones. A representative specimen of this type is figured in the author's preliminary report for 1896. This ware is not as fine as the characteristic cream and yellow ware of Sikyatki, but is often made of a finely ground clay sufficiently well burned in firing to give fine specimens.



FIG. 88. Ornamented rough bowl from Four-mile ruin (number 177148).

GILA TYPE

The characteristic pottery of the Gila valley is a brownish ware, ornamented with red, and is very easy to identify. A specimen of this ware has been figured in color in a preliminary report for 1897. As far as is known, this kind of ware is generally confined to the Gila-Salt river basin. In the excavations of the cemeteries at Four-mile ruin two specimens of this peculiar ware were discovered, but the author does not regard the adventitious occurrence of these specimens, so different from the others in the same ruin, as anything more than examples of intrusion, and believes that they were brought there from a distance. As a rule, there is considerable similarity in the coarse types of pottery from Four-mile ruin and from Pueblo Viejo, the upper part of the Gila valley, which the author has not regarded as illustrating a theory of transportation of specimens; but the sporadic appearance of a prominent type of Gila pottery so different from the others appears to him to demand such an explanation. We may suppose that these specimens went over the watershed of the Gila and Little Colorado in the packs of traders, or possibly were carried by migratory clans. They were not manufactured by the people in whose cemeteries they were found.

FORMS

There is nothing peculiar in the forms which the pottery from this ruin assumes, though there were a few specimens different from any yet obtained from the Southwest. One of the most beautiful of these was a globular vessel of red ware, with a graceful neck and symmetrical handle. The ornamentation on this vessel was black and glazed, the design representing a highly conventionalized bird. This specimen was perfect, with the exception of a small chip in the lip of the orifice. Although a long search for the missing fragment was made it could not be found.

An oval vessel with a hollow handle with external opening recalls similar objects called canteens in other reports. They were doubtless used for transportation of water, and may be classified as a ceremonial type of pottery.

An unusual form, seen in figure 89, is shaped like a saucer, and is



FIG. 89. Small saucer from Four-mile ruin (number 177131).

decorated exteriorly with an artistic arrangement of triangles in black, bordered with white lines.

Food bowls predominated in the collection, and the majority of the vases were small.

DECORATION

The contribution of the picture writing on pottery from this ruin is highly instructive, and connects the people of Four-mile ruin with those of Homolobi and Cheylon. As on the pottery from the latter ruins, bird figures are particularly abundant, but there are representations of human beings, mammals, reptiles, and insects.

While, however, there is a general similarity between the ceramic pictures of this ruin and those of the pueblos mentioned above, this resemblance does not extend into details, and the same may be said with regard to other pueblo paleography. The picture writing of each pueblo has an individuality which seems to indicate that it was

independently developed, adapting certain general forms or patterns to special ideals. The causes of this divergence in the designs on ancient pottery are no more comprehensible than the differences in the decoration of modern pottery in two different pueblos. Why, for instance, should the symbolism of Walpi differ so markedly from that of Zuñi, when there are so many points in common between the rituals of the two pueblos? The differences in the pueblos are mainly due to their clan composition, to the relative prominence of different families in them.

HUMAN FIGURES

The student of the modern Hopi ritual is familiar with the use of helmets in ceremonial dances, and the author has pointed out the limitation of those helmets to the rites from the advent of the *katecinas* at the winter solstice to the Niman, their departure in July. *Katecina* dancers among the Hopis are masked, and they are the only masked dancers in the calendar. Studies of the ancient pictography from Sikyatki have not revealed a single figure wearing a mask; but the majority of the human figures on modern pottery wear masks or ceremonial helmets. The interpretation which is advanced for this fact is that the ancients in Tusayan were not familiar with masked figures, not having them in their rites, but that in the growth of the ritual new clans, in modern times, introduced masked *katecinas*, and consequently modern potters now make figures of them on their pottery. The logical conclusion would be that, if we find in any ruin a picture of a masked personage, the inhabitants of that pueblo must have seen a *katecina*. One of the pictures found on a bowl from Four-mile ruin leads to the belief that *katecinas* were known in that pueblo, for it represents a masked dancer (see figure 90).

The design may be interpreted as follows: The figure is evidently intended to be a drawing of a human being. The head has the form of a mask, in which are slits for eyes; the knobs represent feathers. The three semicircular figures on the lower end of the body resemble rain-cloud symbols, and the double row of rectangles with inclosed dots recall the symbol at present used by the Hopis to represent an ear of maize.

There is little doubt that the figure shown in plate XXIV represents a human being. All parts except the head are recognizable, and as we know from another specimen that ancient Pueblo artists could represent a human head very cleverly, we are called upon to explain why they substituted for a head the strange device which is found here. The possible explanation is that it represents a mask. The designer intended to figure a masked human being or *katecina*. Now, different *katecinas* are distinguished by symbols drawn on their masks or helmets, consequently the next step is to compare the helmet of the masked figure from the Four-mile ruin with those known in the Hopi system.

The author finds one highly suggestive appendage to the head—the radiating crest resembles the feathers in figures of a mythical conception called Shalako. We have here a picture with a helmet adorned with a crest of feathers, recalling a Shalako, which is a Zuñi as well as a Hopi conception, derived in Tusayan and Zuñi from the same source, or from some of the ruins along the tributaries of the Little Colorado. The logical conclusion would be that the people of Four-mile ruin likewise recognized this being.

Apropos of the possibility, revealed by this picture of a masked



FIG. 90. Human figure on food bowl from Four-mile ruin (number 177061).

dancer, that masked or katchina dances were once celebrated at Four-mile ruin, attention is called to the short distance of this ruin from a legendary home of the katchinas near St John, New Mexico.^a Both Hopi and Zuñi legends regarding the ancient home of these beings cluster so definitely about a ruin near this town that we may suppose that the former inhabitants of that mythical place possessed a knowledge of the cult. To the lake near by both Zuñis and Hopis

^a Kothualewū of the Zuñi legends; Wunema of the Hopi. It would be a most instructive work from a mytho-archeological point of view to investigate the antiquities in the neighborhood of St John, especially near the lake so often mentioned in legends.

make pilgrimages for sacred water; here, likewise, they carry prayer plumes. The locality is sacred to the priests of the katecina cult in both pueblos. The logical implication is that some of their ancestors once lived there.

The distance of the Four-mile ruin from this place so closely connected with the katecina cult is not as great by many miles as between it and Walpi, not much greater than between it and Zuñi; so that it is certainly not improbable that the cult which has made its influence felt on these modern pueblos should have been practiced in the pueblo now called Four-mile ruin.

Another picture of a human face, body, and arms is also instructive. The head of this figure (see plate XXV *a*) is unlike any other, but the appendages are closely paralleled in figures on certain ancient vessels from Oraibi. The mouth is represented by a triangle, as is also the case in modern Hopi pictures of the sun god. The arms to the elbows are raised to a level with the head, which is circular, with two large eyes. The two appendages shaped like quadrants are supposed to represent feathers. The bowl on which this picture occurs is broken, but it is one of the most beautiful specimens of red ware in the collection.

A rude figure of a quadruped decorated one of the largest food bowls found at Four-mile ruin. Designs of this kind are common in pictographs, but are rarely present in pottery decoration. It has been suggested that this figure was intended to represent a dance figure, and that the caudal appendage shows the fox skin which is at present almost universally worn by participants in the sacred dances. It is a widespread belief among the pueblo people that in early times, more especially when the human race inhabited the under worlds, human beings had tails.^a Perhaps the ancient potter had this myth in mind when some of the human figures represented on old pottery were painted.

QUADRUPED FIGURES

One of the best examples of picture writing from Four-mile ruin occurs on a vessel of fine chestnut ware not unlike that of Sikyatki. The author formerly regarded this as a picture of a reptile, or possibly of a horned toad, but there are reasons for identifying it as a quadruped, possibly the raccoon.

The general form of this figure is shown in plate LX *b*. The head has a triangular appendage, the throat is spotted, and the jaws are armed with teeth. Two eyes are placed on one side of the head, as is often the case in Pueblo drawings of animals. The body is crossed by parallel and zigzag lines, and in places is decorated with crosses and dots.

The quadruped figures on the exterior of bowls are mentioned later.

^aMany ancient legends refer to the caudal appendages of men in very ancient times, and it is sometimes stated that their tails were cut off by a cultus hero. These traditions are not confined to the Hopis, but are reported from other pueblos.

BIRD FIGURES

Figures of birds predominate in the pictography of all the ancient pueblo ruins which have been studied. This is true no less of Four-mile ruin than of those lower down on the Little Colorado river. In their delineations of bird figures, however, the artists took strange liberties with nature, representing birds unknown to students of ornithology. One of the most interesting of these from Four-mile ruin was a toothed bird drawn on the interior of a food basin. That



FIG. 91. Bird design on food bowl from Four-mile ruin (number 177203).

this picture was intended to represent a bird would seem to be shown by the representation of wings and tail, though but for the latter organ it might be suggested with some justice that a bat was intended.

In all these representations of mythical animals the imagination had full sway. It was not the bird with which the artist was familiar through observation, but a monstrous creation of fancy, distorted by imaginations—real only in legends—that the potter painted on her vessels. Hence, we can not hope to identify them, unless we are familiar with the mythology of the painters, much of which has

perished. The comparatively large number of bird figures on the ancient pottery indicates a rich pantheon of bird gods, and it is instructive to note, in passing, that personations of birds play important parts in the modern ceremonies which have been introduced into Tusayan from the south.

One of the best figures of a bird found at Four-mile ruin is shown in figure 91. The various organs can be recognized without a detailed description, but the form of the wings is somewhat different from that thus far shown in pictographs.

In the next design (figure 92) we have at opposite angles of a rectangular figure representations of birds, alternating with triangles drawn on the remaining angles in a characteristic Zuñi and Hopi manner. This is one of the few figures in which birds are represented by triangles.

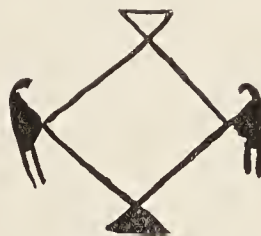


FIG. 92. Bird design on food bowl from Four-mile ruin.



FIG. 93. Bird designs on food bowl from Four-mile ruin (number 177170).

The bird design reproduced in figure 93 shows a long curved snout, and parallel lines representing feathers on tail and wings. The two legs are thrown out of perspective, but so closely do they resemble

those of some other bird figures that there can be little doubt of their homology. In the same inclosure in which the bird is depicted there is also a figure of a dragon fly, and outside the inclosure is a picture of another bird. This is one of the most interesting avian pictures from Four-mile ruin. The representation of tail feathers by parallel lines in this figure is corroborative of the same interpretation of parallel lines elsewhere shown on ancient Pueblo pottery. The form of the head and the long curved beak is common in several other pictures of birds, and an effigy vase with beak of a like structure is described from Cheylon ruin in the report of the expedition of 1896.



FIG. 94. Bird design on food bowl from Four-mile ruin (number 177173).

A very highly conventionalized bird figure is shown in figure 94, where the different parts are represented by geometrical lines.

BUTTERFLY FIGURES

A large and beautiful food bowl of red ware (plate XXV *b*) found at Four-mile ruin, had an unusual design representing a moth or butterfly, probably the latter, depicted on one segment of the interior. In this design (figure 95) two eyes are represented on one side of the head, there is a coiled antenna, and the body and the border of the wings are marked with rows of dots. These dots are common features in butterfly figures, as may be seen in modern drawings of this insect among the Hopis.

FEATHER DECORATION

Representations of the feather, often highly conventionalized, are very common in the designs on ancient Hopi pottery, and, as the author has shown in a previous article, different kinds of feathers have characteristic forms. These designs have been detected thus far in the ruins about the inhabited Hopi villages, at Sikyatki, Shumopovi, and Kisakobi or old Walpi. They have not been found, with one exception, in the ruins along the Little Colorado river, though

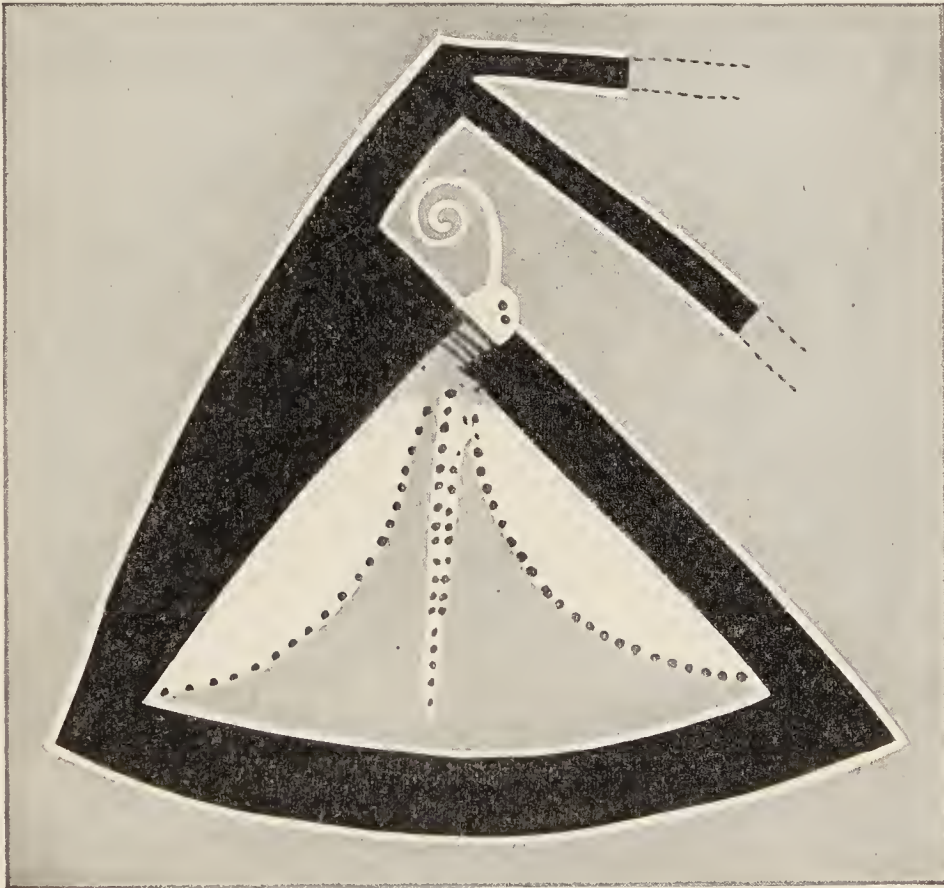


FIG. 95. Butterfly design on food bowl from Four-mile ruin (number 177110).

the author has been able to examine much larger collections from this region than from either Shumopovi or Kisakobi.

One of the feather symbols was shown to be the triangle, a form of which is still preserved in the decoration of modern ceremonial paraphernalia. This type of feather design seems to be common in the Little Colorado pottery, but is more difficult to recognize and is also less common here than it is in the highly instructive symbolism of Tusayan.

GEOMETRICAL FIGURES

There were many specimens of pottery from Four-mile ruin decorated with the various geometrical figures so common on all ancient Pueblo ware of northern and central Arizona. The types were terrace figures, spirals, frets, bands, dots, bars, and zigzags. The proportion of geometrical figures, as compared with representations of animals, was large. As we investigate ruins more and more distant from those about the Hopi villages, this proportion increases; and if we considered geometrical motives as older and simpler than



FIG. 96. Sun emblem on food bowl from Four-mile ruin (number 177058).

figures of animals, it would seem that pottery ornamentation reached a higher development in Tusayan, where drawings of animals and human forms predominate.

The geometrical figures on the outside of food bowls from the ruins on the southern affluents of the Little Colorado are more elaborate than those on the northern (see plate LXIII). Modifications of the broken line, either in spirals, frets, or bands, are common features of the ruins in both regions.

An instructive piece of pottery from Four-mile ruin was a small food bowl ornamented on the interior with a ring (see figure 96), from which radiated serrated bars, the significance of which is unknown.

In the rich collection of Sikyatki pottery the author found a larger food bowl, the interior of which was also decorated with a ring, and to this ring undoubted feather symbols were added. It may be sug-



FIG. 97. Bowl with double spiral design, from Four-mile ruin (number 177102).

gested, therefore, that the serrated appendages to the ring in the above-mentioned specimen may likewise be conventionalized feathers, and there are other grounds for interpreting them in this way.



FIG. 98. Decorated vase from Four-mile ruin (number 177234).

The small food bowl shown in figure 97 is ornamented with an exceptional design, a spiral enlarging from the center to the rim of the bowl. This bowl is interesting as the only one of a pronounced heart shape. This form of spiral is instructive, showing the break in the line so characteristic of ancient Pueblo designs.

The decoration shown in the accompanying cut (figure 98) is peculiar, but effective. The two vertical lines on the neck are repeated on the opposite side. Similar markings are found on vases, food bowls, dippers, and ladles in all Tusayan ruins, and represent feathers.

The design shown in the next cut, figure 99, is unique among all forms of ornamentation known, and its meaning is incomprehensible to the author.

One of the most characteristic designs, with a spiral motive, is shown in plate LXIV, which is typical of many figures on Four-mile ruin pottery. This design is characteristic of the Little Colorado river ruins, especially on the red ware so common in them.

The general character of the geometrical ornamentation of food bowls may be seen in plates XL-XLII, LXIII.



FIG. 99. Unknown design on food bowl from Four-mile ruin (number 177126).

EXTERNAL ORNAMENTATION ON FOOD BOWLS

In his account of the ceramic objects found at Sikyatki the author has figured some of the more prominent designs from the exterior of food bowls and has attempted a discussion of their significance. In the abundant material collected from that ruin no specimen was found with figures of animals, with the exception of a highly conventionalized bird. Spiral designs were very rare, the main forms being rectangular geometrical designs with added feathers. In two instances

there were human hands or animal paws. A dot with parallel or slightly radiating lines was a common feature, and the ornamentation was, as a rule, confined to zones or limited to one point on the rim.

The external decoration on food bowls from the Four-mile ruin differs greatly from that of the Sikyatki collection. Both rectangular and spiral designs occur, and several specimens have figures of mammals and birds.

As a rule, the external decoration is continuous on the outside of the food bowl, and is not, as is generally the case at Sikyatki, confined to one portion. Some of the typical forms of external decoration are shown in plate LXIII.

In the account of the pottery from Sikyatki attention is called to the predominance of straight lines and rectangular figures on the



FIG. 100. Bear design on exterior of food bowl from Four-mile ruin (number 176999).

exteriors of the food bowls. Curved lines, and especially spirals, were practically absent in this decoration. This is also true of the collection of food vessels from Shumopovi, where a considerable number were obtained in 1896. Another peculiarity of the external ornamentation of Sikyatki pottery is a design in which we have a dot from which extend short parallel or slightly divergent lines; these have been interpreted as representing a *nakwakwoci* or feathered prayer string.

The external designs on food bowls from the Little Colorado ruins have a large proportion of spirals, and thus far there have not been found the dot and appended parallel lines mentioned above. It seems, therefore, not improbable that this particular form of the feather is peculiar to ruins in the immediate vicinity of the present Hopi pueblos.

On one of the food bowls from Four-mile ruin there was a representation of a large mammal which calls to mind a bear (see figure 100). This is the only instance known to the author of a representation of this animal on the outside of food vessels.

Pictures of birds are found on the outside of several bowls. One of the most exceptional of these is the "twin-bird" design (figure 101),

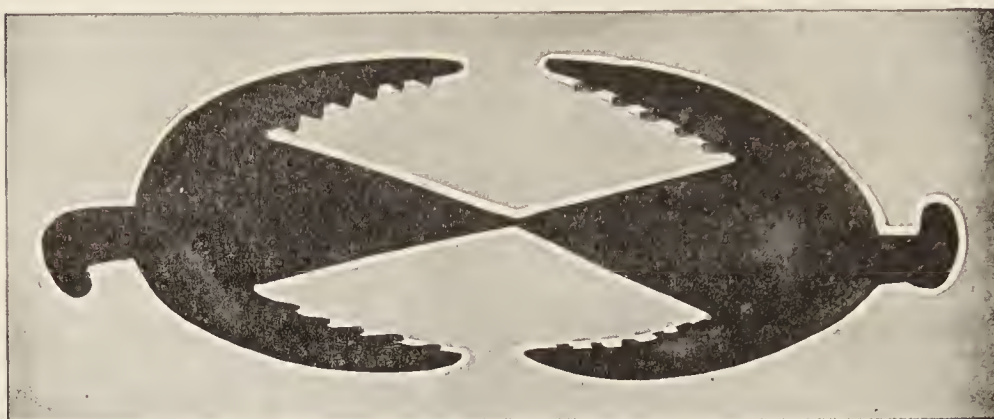


FIG. 101. Twin bird design on exterior of food bowl from Pinedale (number 176888).

which represents two birds attached by their tails. These peculiar forms are likewise found at Pinedale and other ruins high up in the White Mountain reservation.

The figure of the bird shown in figure 102 is found on the exterior of a food bowl from Four-mile ruin, and is one of the few bird draw-

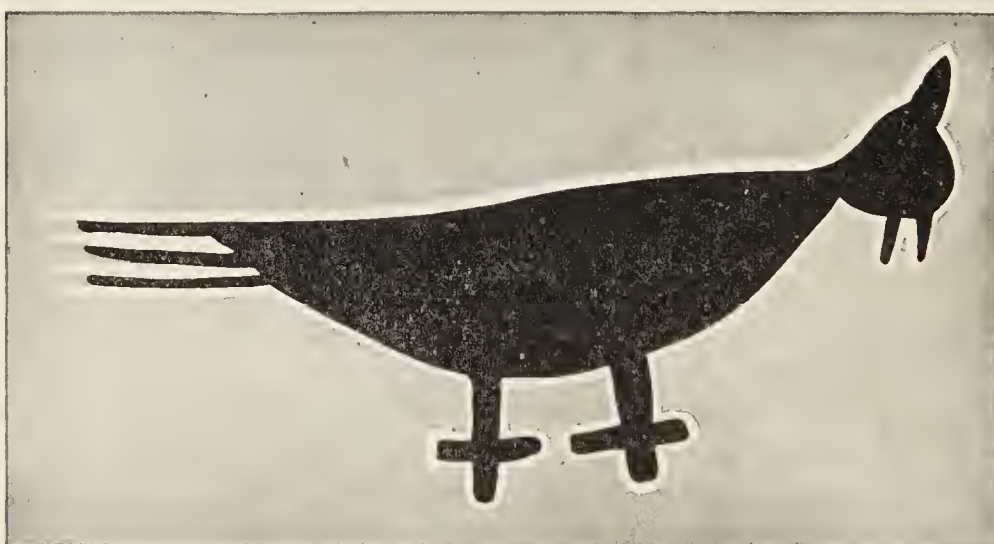


FIG. 102. Bird design on exterior of food bowl from Four-mile ruin (number 177378).

ings from the outside of a bowl. The manner of representing the claws is one often adopted in avian figures. Parallel lines, for tail feathers, are repeatedly found in Southwestern pietography.

On one of the food bowls we find the accompanying symbol (figure 103), which reminds one of the modern rain cloud, so prominent in Hopi symbolism. It has, however, resemblances to the paw

of the bear or badger, and from the fact that a mammal identified as a bear is found on the exterior of the bowl illustrated above (figure 100), it is probable that this symbol likewise should be referred to that animal.

The very chaste form of geometrical decoration shown in figure 104

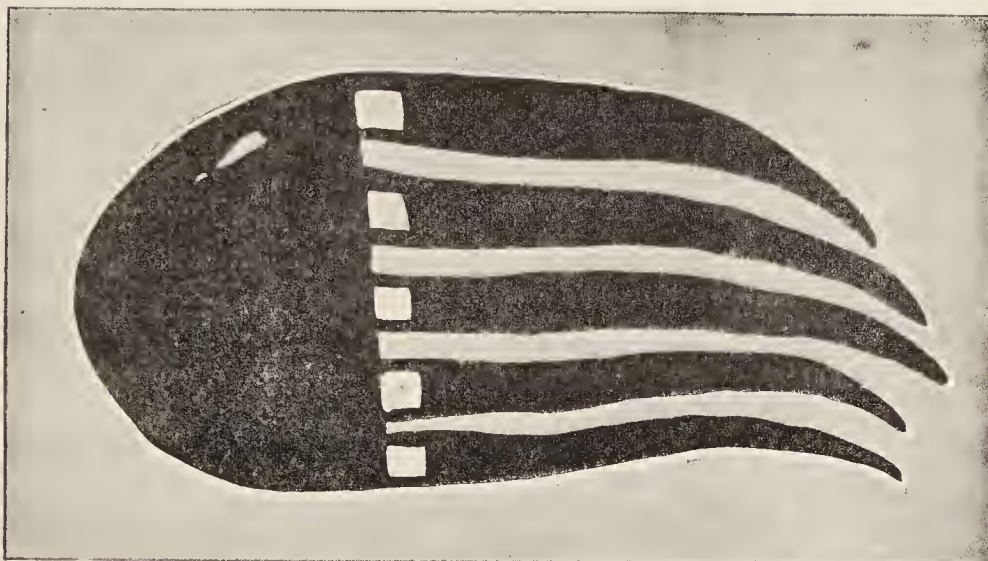


FIG. 103. Bear's paw design on exterior of food bowl from Four-mile ruin (number 177277).

was found on the outside of a food bowl from Four-mile ruin. It is a composition of triangles, T-shaped figures, and terraced designs, arranged on a shaded rectangle.

RAIN-CLOUD DESIGNS

Three types of rain-cloud symbols are used in the modern Hopi ritual. These are the rectangle, the semicircle, and the triangle. The two former are ordinarily triline. We have either three semicir-



FIG. 104. Geometrical design on exterior of food bowl from Four-mile ruin (number 177000).

cles or three rectangles combined, the latter appearing as a stepped figure. The number of components may be multiplied, in which case we find many semicircles approximated, their shapes somewhat modified by the juxtaposition, or many rectangles combined, forming terraces.

It is easy to mention instances of rectangular rain-cloud symbols represented in the modern ceremonial paraphernalia. We find them carved into tablets on the heads of many dolls and idols. The Humis kateina dancers wear them on their helmets. They are painted on the uprights of altars, woven into baskets, and embroidered on sacred dance kilts.

This terraced form occurs as a rain-cloud symbol on several bowls from the ancient ruin of Sikyatki. It is also found on mortuary stone slabs at the same ruin. The four sides of the ancient shrine in the Awatobi kiva had rectangular rain-cloud symbols of different color, showing that this form was recognized in this pueblo. The author has elsewhere pointed out its existence in the Homolobi ruin, and now the same type is reported from Four-mile ruin. While, as a general thing, this form is the predominating type of rain-cloud symbol used in the kateina celebrations, it is not confined to them, but is also found in the Flute ceremonies and elsewhere.

The semicircular type of rain-cloud symbol is no less common than the rectangular in the modern decorations, and, while most abundant in ceremonials which occur between the departure of the kateinas and their advent, it is not wholly absent in the masked dances. This form has not yet been found on ancient Hopi pottery—which fact leads to a belief that it is of late introduction. It is, however, very conspicuous in the ceremonials introduced into Tusayan by the Patki or Rain-cloud people, and it is a significant fact that the totemic signatures of members of this family have the same form. A ready explanation of the existence of this motive in Walpi would be that the southern clans introduced it, and its occurrence in the Snake ceremony would be interpreted as an example of intrusion.

The semicircular type of rain-cloud symbols is not considered a development of the rectangular, or vice versa; but it is thought to be a new symbol of foreign origin, the rectangular being the older in this particular locality.

The triangular rain-cloud symbol is less common in modern designs, and is rare or unknown in ruins near the modern towns. The majority of examples of it come from the Little Colorado ruins, but it occurs on some of the idols used in Walpi at the present day.

A food bowl decorated with triangles arranged in such way and with such an association that they may be interpreted as rain-cloud symbols was found at Sikyatki, but this interpretation is doubtful. Another bowl from Shumopovi admits of the same interpretation.

A symbol of the rain cloud among the people of the pueblo—now a ruin—at the mouth of Cheylon fork, was a triangle inclosing a rectangle. These symbols were found on a stone slab excavated from that ruin in 1896, and were figured in reports of the work accomplished in that year (see plate XLVI). A beautiful large food vessel

dug out of the north cemetery at Four-mile ruin, shown in figure 105, is decorated with triangles which are also supposed to be rain-cloud symbols. Above them is a semicircular band which is identified as a representation of the rainbow.

An example of the triangular form of symbol representing the rain cloud is found on one of the effigies of the Flute altar, and is figured in an account of the Walpi Flute observance.^a Many of the rattles used in kateina dances have on each of their flattened sides four tri-



FIG. 105. Cloud emblem on food bowl from Four-mile ruin (number 157352).

angles united at one angle, and with parallel lines representing falling rain on the sides opposite their union. These figures have a distant resemblance to feather symbols, as may be seen by comparison with some of the bird designs from Cheylon ruin.

It will be seen from the foregoing account that there are three types of rain-cloud symbols in use in the modern Hopi ritual, the semicircle, rectangle, and triangle.

In the same way it can be shown that there are at least two types

^aJournal of American Folk-Lore, v. 8, n. 27, pl. II, fig. 1.

of sun symbols, and there are other instances which might be mentioned of two or more symbols representing the same thing. This duplication is explained by the composite nature of the tribe, one family adding one type, another a second, and so on. In the amalgamation of the clans each of these symbols becomes no longer limited to the family which brought it to the pueblo. While the semicircular rain-cloud symbol predominates, the survivals of the triangular and rectangular are numerous and suggestive.

The oldest form in Tusayan, so far as archeology teaches, is the rectangular, but the triangular is possibly equally ancient in the ruins along the Little Colorado.

CHARACTER AND TREATMENT OF MORTUARY POTTERY

It must be confessed that the pottery now placed over the dead is of poor quality and scanty in quantity, as compared with that used by the ancients for that purpose. The fine ware rarely serves this purpose, but is retained in the household. It may be interesting to note that among the modern Hopis special pottery objects are not manufactured for mortuary purposes, and the same is true of ancient burials. In the latter many of these objects show manifest signs of former use in the household.

To what extent the survivors of the deceased purposely broke mortuary vessels, nicked fragments from them when they were deposited in the graves, or in other ways symbolically "killed" them, it is very difficult to say. Many mortuary vessels have been found which were as perfect as when made; others were undoubtedly purposely broken before they were deposited with the dead. The great pressure of the earth above them doubtless fractured the largest number, and many were broken while being extracted from the soil. There is no direct evidence that mortuary pottery was ever to any great extent purposely broken before it was deposited in the cemeteries of Four-mile ruin.

POTTER'S OUTFIT

One of the bodies exhumed from the northern cemetery was accompanied by a potter's "outfit," consisting of the different ingredients used in making pottery and of smooth stones and other implements with which it was made. In other ruins the author has found masses of potter's clay such as are used by the potter, but nowhere as complete a collection of clays, pigments, and the like as in this grave.

The objects were:

1. Knife made of a rib, for cutting clay
2. Knife made of a rib, for cutting clay
3. Stone for rubbing, stained green
4. White clay
5. Yellow clay
6. Greenish clay
7. Micaceous hematite

STONE IMPLEMENTS

Comparatively few stone implements were collected at Four-mile ruin, and they were, for the most part, so similar to those from other Little Colorado ruins that much space need not be here devoted to them.

There were found several serrated stone implements which seem worthy of special mention. They are made of hard stone, chipped to a sharp, toothed edge. The use of an implement of this kind is obvious; for with it, as with a file, a number of mechanical operations, such as sawing, filing, and scraping, are possible. Specimens of this form occur at almost every large ruin at which the author has worked in the last two years, and many of them were picked up from the surface of the ground.

The number of small stones showing pecking or artificial working which can be found at a Southwestern ruin is much larger than the proportion in collections would seem to indicate. From their great weight, as well as their numbers, the majority have to be left behind, and as a rule those which are destitute of a special form are rejected.

It was apparently the Indian custom to pick up any stone near at hand, to use it for pounding or other purposes as long as needed, and then to cast it away. It thus happens that innumerable stones slightly pecked on one or all sides, but without the form of any implement, are very numerous upon the mounds of almost every ruin.

The burials in the north cemetery were deep, and there was evidence that a considerable quantity of soil had been deposited over them, having been washed down from neighboring mounds. A few feet below the present surface of the ground in this superimposed soil the stone object shown in figure 106 was found, the probable use of which was a subject of some speculation. Having occasion later to open a room in the mounds above the point where this stone was discovered, the author found on the floor, several feet below the surface of the soil which filled the room, other specimens having the same general shape and character. In a gully between the room and the cemetery there was still another of these objects—making in all seven specimens.

The localities in which these stones were found indicated that they all belonged together, and that the two found outside the room had been separated from the others and had been rolled down the sides of the mounds, perhaps by the water, the course of which is marked by deep gullies in their sides. The forms of all these stones are much the same, irregular, ovate, with one flat side, and truncated at one pole. They were evidently fashioned with care, and, as the rock is hard, they must have been made with considerable difficulty. All had a small pit or depression on the flat side near the rounded pole.

Several suggestions were made by members of the party regarding the possible use of these stones, of which the following seemed to be

the best: That these stones are simply supports for rods used in weaving girdles, especially the great white sashes worn by kateinas. Identical supports for rods of this kind are used at the present day for the same purpose.

The frequency with which stones used for grinding corn are found in graves may be explained by their prominence in the life of the women, in whose graves they generally occur. These utensils are ordinarily found in a reversed position near the middle of the body. The custom of burying metates in graves is known from the ceme-



FIG. 106. Stone used in belt frame, from Four-mile ruin.

teries at Sikyatki, Homolobi, Cheylon, Chaves pass, and Four-mile. A doubtful instance occurred in the Kintiel burial ground, where a metate was found in the graveyard, but not near any skeleton.

STONE SLABS

The presence of stone slabs, some of which are of considerable size, has been recorded in several ruins of New Mexico and Arizona, and these objects were also found at Sikyatki, Homolobi, and Kintiel. Several of these specimens were collected at Four-mile ruin. Many of the perforated stones were extracted from the floors of the kivas,

others, generally with an orifice of larger size, from the soil covering the rooms.

It has been suggested that some of these perforated stones were formerly built into walls of rooms to partially close the passageway,



FIG. 107. Stone slab from Four-mile ruin.

but their presence in graves is not readily explained by this theory. Their fashioning demanded considerable labor, and the author recalls one of these perforated stones where the edge had been worked smooth with great care.

In his report on the operations in 1896 at Homolobi and the Chevelon ruin, the author called attention to the presence in graves of stone slabs on which figures of rain clouds were depicted, and in the excavations at Sikyatki he found similarly decorated stone objects. The practice of burying stone slabs ornamented with rain-cloud symbols was not unknown at Four-mile ruin, as one of the objects from graves at that place attests. This specimen has a rectangular form and is decorated with a terraced rain cloud painted in black outline on one side. It is possible that the grave from which this slab was taken was that of a priest, and that this object was formerly used in ceremonies, as is the case with certain altar paraphernalia of the same character in the modern ritual of the Hopi Indians. The representation of the rain cloud on a mortuary stone slab is the expression of the idea that the dead become rain makers or rain gods. This form of ancestor worship is a highly modified one, which can be directly traced to the arid environment in which the ancient people lived, and their status as agriculturists, which made rain a prime necessity to them.



FIG. 108. Copper bell from Four-mile ruin (number 177804).

This slab was likewise decorated with a row of triangular markings, and had perforations at the corners. A second slab, of less regular form, was likewise found at Four-mile ruin, but upon it the terraced rain-cloud figures were not as distinctly drawn as on the preceding. There was also found a stone slab with rectangular figure of unknown meaning drawn upon it with black pigment. A stone slab somewhat like this was found at Sikyatki in 1895.

While strolling over the mounds the author found a slab of stone of unknown use (figure 107). It was set upright and photographed. The object was about 4 feet long and about 8 inches wide, tapering slightly, and smooth on all sides. This slab had without doubt been worked into a regular form, and was a lintel of a doorway or some other part of a house.

COPPER BELL

The occurrence of bells made of copper has been recorded from several ruins in Arizona. The specimen obtained at Four-mile ruin (figure 108) is in no respect different from those previously mentioned, and belongs to the type constantly found in the Gila valley and in old Mexico. From the limited number of these bells in Arizonian ruins very meager conclusions can be drawn, but the author supposes that they were introduced from the south, rather than that they were manufactured by the former inhabitants of the ruined pueblo. There are indications of great antiquity in some ruins where they have been found.

The bell was taken from the hand of a skeleton exhumed from the cemetery north of the pueblo. It was much corroded, and broken on one side, and the small stone which served as a clapper had become firmly fixed to the inner wall by the corrosion of the copper.

PRAYER-STICKS

No fragments of mortuary prayer sticks were found in the cemeteries at Four-mile ruin, but this negative evidence does not prove that they were not in use among the inhabitants. The soil is so moist that there is doubt if these wooden objects would last long in it, though their preservation in the Cheylon ruin, where somewhat similar conditions prevail, shows that their absence at Four-mile ruin may furnish positive proof that they were not used in burial.

GOURD RATTLES

One of the instructive objects taken from the north cemetery at Four-mile ruin was a rattle made of a small gourd. This rattle had an oval shape, and was decorated with red and green paint, on which was the impression of feathers. The handle, which was broken from the rattle, was not found. The occurrence of this gourd rattle, identical with those still used in Pueblo ceremonies, gives archeological evidence of its use in ancient times, probably as an accompaniment to songs in religious rites.

ORNAMENTS

Although fully as many skeletons were exhumed from Four-mile ruin as from some others, the small number of marine shells, as compared with those found at Homolobi and Chaves pass, was noticeable. Though the ruin is situated in a latitude south of Chaves, only a few fragments of shell were found there, while there were several hundred specimens from the latter ruin. This can be explained only by the theory that the Chaves pass and Homolobi people had more marine shells than those of Four-mile ruin, that they were in more direct contact with the ocean, or with people who obtained them from the sea by barter or otherwise, thus indicating a direct relationship between them and peoples of the south. The ancient trade in sea shells was along the Gila river, up its northern tributaries, and across the Mogollones to the Little Colorado river. Chaves pass was in the direct line of this trade; Four-mile ruin was not, and the scarcity of sea shells in the latter locality is explained by its distance from the sea and the difficulty in reaching tribes nearer the Gulf of California.

The scarcity of beads and turquoise ornaments in the collections of 1897 was in marked contrast with the wealth of these objects at Homolobi and Cheylon. While this rarity may be in part due to the limited amount of soil removed in the work, it must also be remembered that the pueblos which were excavated in 1897 were smaller.

BONE IMPLEMENTS

The bone implements found at Four-mile ruin were similar to those collected in 1896 at Chaves pass. They consisted of awls, needles, and bodkins, many of which were made from the wing and leg bones of the wild turkey or the tibiae of antelopes. There were also larger implements made of the bones of antelope and deer.

ANIMAL REMAINS

A large collection of animal bones was obtained from the rooms at Four-mile ruin, but they have not yet been identified.

RUINS NEAR FOUR-MILE RUIN

Within a radius of a few miles of Snowflake there are several ruins, some of which are of considerable size. The ruin near Shumway is one of the largest of these, and would well repay extensive excavations. There are ruins on the opposite side of the creek from Four-mile ruin, but these are smaller, and the elevations on which they stand have been diminished by deposition of the soil by the stream about their bases. The cemeteries have been so deeply buried under the accumulated earth that extensive excavation would be necessary to lay bare the objects which they contain, and, as the mounds themselves are small, the author did not attempt this work. The collections made at Four-mile ruin will undoubtedly serve as typical of those which could be taken from adjacent mounds, as the people of this whole neighborhood were probably in about the same stage of culture.

RUINS AT PINEDALE

THE BUILDINGS

The road leading south from Holbrook to Fort Apache, in the White mountains, divides just beyond Taylor, and one division continues to a small settlement among the pines, which is called Pinedale. This is a beautiful place to camp, surrounded by high trees, is well watered, and in places has fertile stretches of land suitable for farms. Two extensive ruins reported to me from that locality by Mr Frank Zuck, of Holbrook, promised interesting results if proper excavations were made in or near them.

Accordingly, work was begun, with 5 Mexican laborers, near the middle of July, and extensive excavations were made in the larger ruin. The results were not as satisfactory as had been hoped, but several important facts were brought out by the attempt. A small collection rewarded the work at this place.

The two Pinedale ruins lie on either side of the road just beyond the church of the town, and a few hundred feet from the new stone schoolhouse, one of the best in this part of Arizona.

Of these two ruins, that on the left of the road is the remains of a pueblo of compact form, with a central plaza obscurely indicated. From the general appearance of the ruins it is judged that the pueblo was at least several stories high, but no sign of wall was seen above ground.

The ruin to the right of the road covered more ground than the other. It was of rectangular form and apparently single storied. This ruin was evidently an ancient one, and many tall, fine trees were found growing from the soil in the rooms. The walls, however, had so fallen in that there were not more than traces of houses to be seen marking the former extent of the ruin. There was no evidence at any point that the rooms ever had more than a single story; and evidences of the gateways entering the ancient plaza were sought in vain.

The relationship of these two Pinedale ruins to each other appears to be as follows: The compact ruin on the left side of the road apparently contained the greater part of the population, while the rectangular building served as a place of refuge, for which its mode of construction made it admirably suited. If the theory is a correct one, it is probable that the rectangular portion was of later date than the compact one, and this is also indicated by its general appearance.

At various localities in the Southwest are found in close proximity ruins of buildings which apparently have a somewhat similar relationship. Thus in the Tsegi canyon one sometimes finds extensive ruins at the base of a cliff, and in the caverns above inaccessible cliff houses. Another very good illustration can be seen near Ramah, not far from Zuñi, where there is a fine rectangular ruin on the hilltop and the remains of an extensive pueblo at the base of the same elevation. The more inaccessible of these buildings was probably a place of refuge for the inhabitants of the more exposed pueblos in the plain and their contiguity made access from one to another easy. The same explanation may also be suggested for fortified hilltops near ruins, so well illustrated in so-called trincheras of the Verde valley.

In localities like that of Pinedale, where there were no adjacent caverns or hilltops convenient for fortification, a special building was erected for defense and refuge. This method was adopted in the Buena Vista ruin, situated in the Pueblo Viejo, to which reference will be made later.

It would appear that a specially erected building for refuge and another for habitation is a far less practical arrangement for defense than a combination of both in one. This has led to the building of habitations on inaccessible heights, in caves, or on mesa tops, or to the construction of the pueblo in such a form as to make it easy of defense. Thus, the houses are so placed that the highest wall is on the outside, where it sometimes rises to the altitude of several stories, sloping toward the middle of the town. Entrance into such a walled

town might be either by ladders, which could be drawn on the roofs, or through breaks in the walls or gateways.

The circular form of building would be a natural evolution of this form of a fortified pueblo, a survival of a plan of encampment adopted by nomadic Indians, as others have pointed out. No doubt sociological and other reasons also played a part in the circular arrangement of houses inhabited by different clans, but the principal cause was the need of defense.

COLLECTIONS

From one of the cemeteries of the larger Pinedale ruin several skeletons were exhumed. It was situated close to the outer wall, as at Homolobi and Cheylon, and the skeletons were accompanied with mortuary pottery. There was no good evidence that the ancients in this pueblo burned their dead, and logs or stones were not found over them as at Chaves pass. This was surprising in so well wooded a region. The bodies were not, apparently, wrapped in matting.

The pottery is essentially the same as that taken from ruins farther down on the Little Colorado, and the decorative symbols are much the same as at Four-mile ruin. With the exception of a picture of a bird on the interior of a food bowl, and several more conventionalized bird designs on the exterior of another, no animal pictures were found. The majority of the decorations were of the geometrical type. Rough ware and decorated pottery occurred in about equal proportions. One of the most beautiful specimens of red ware obtained in 1897 was exhumed at Pinedale. The decorations, both interior and exterior, were well made and the ware itself was of the finest type. Mr Zuck discovered this cemetery of the ancient Pinedale ruin in the year 1896, and removed from it several vessels which will compare well with any yet found in the Little Colorado basin. There is evidence, therefore, that as we leave the river the pottery does not deteriorate.

Several forms of bone implements were obtained from the excavations at Pinedale ruin. These came chiefly from the former dwelling rooms, and were rarely found in the cemeteries. They consist of awls, bodkins,

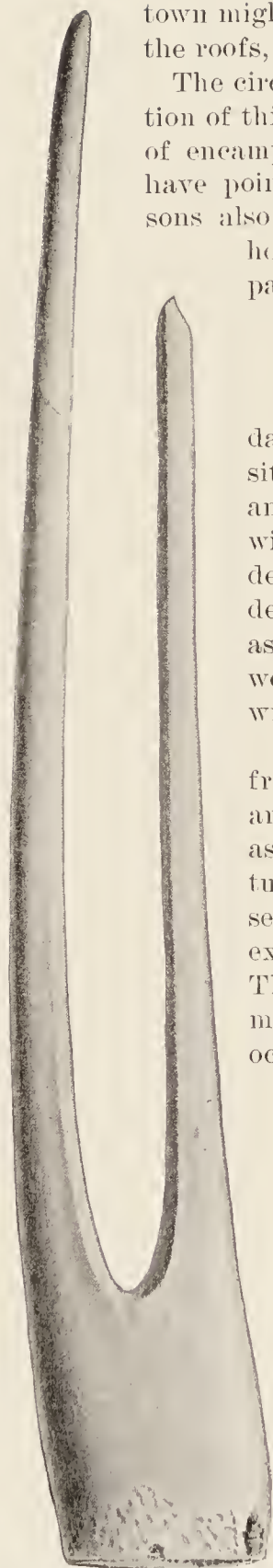


FIG. 109. Bone implement from Pinedale ruin (number 176904).

pins, needles, and pointed implements used in weaving and sewing. The largest specimens were made from the bones of deer and antelope^a; the smaller, for the most part, from bones of rabbits and birds.

A bone implement was found in Pinedale ruin cemetery for the use of which there is no satisfactory explanation. It is made from a human arm bone, cut off a short distance from the trochanter. There can be no doubt that the cut is artificial, as the marks of a primitive instrument are visible, while there was evidently an effort to polish or otherwise work the surface of a similar specimen. The majority of these bone objects were made of the humerus of the wild turkey, one only being made of a human bone.

One of the most exceptional bone objects found at Pinedale was an implement with two long prongs, unfortunately broken at the end (see figure 109).

A shallow house-burial in one of the rooms of the ruin to the right of the Pinedale road contained calcined bones, evidently human, a copper buckle, and a few army buttons showing the action of fire. This was evidently an intrusive burial, much later than the others, and there is reason to believe that it was made long after the room in which it was found had been deserted, though there was no way of telling whether the fragments of the skeleton were those of an Indian or white man.

The tall trees growing from the débris filling the rooms of the rectangular ruin at Pinedale show that the pueblo was of great age. Fortunately, one of these had been sawn down, revealing the number of rings indicative of its age. Though it was not possible to count these with certainty, over 100 concentric layers could be made out without difficulty. In the room where these metallic objects were found grew one of the largest of the trees.

A considerable collection of crania was made at Pinedale, as at Kintiel and Four-mile ruins.

STOTT RANCH RUIN

During the troubles in the Tonto basin a few years ago, a party from the basin visited a ranch owned by a man named Stott, a few miles west of Pinedale, and hanged him for alleged horse stealing. The ruin called by his name is a few rods from his cabin, now deserted. It is a fine ruin situated in a beautiful park of lofty pine trees, and offers opportunities for archaeological study, but is inconvenient for extensive work on account of its distance from a base of supplies, the nearest place, Pinedale, affording only a limited supply of provisions. In general character this ruin resembles those near Pinedale, and the few fragments of pottery which were picked up on the surface are identical with those from Four-mile ruin, near Snowflake. A mile or

^aThe pueblos near haunts of deer and antelope have a larger proportion of bones of these animals; those in the plain have more bones of rabbits and birds. The fauna of the region is accurately reflected in the bones found in its ruins.

more southwest of this ruin there is still another, much smaller, crowning a hill top, with evidences of a considerable former population. Many fragments of pottery were strewn over the surface of the ground, and a few foundation walls were traced, especially on the highest point of the hill, but none of these rose above the surface of the mounds. The general character of all these ruins is the same as that of the Little Colorado series.

RUINS IN PUEBLO VIEJO

THE VALLEY AND ITS HISTORY—GENERAL FEATURES OF THE RUINS

It will be seen by an examination of a map of Arizona that the ruins at Pinedale and Stott's ranch are very near the sources of some of the southern tributaries of the Little Colorado. They are situated high up on the northern foothills of the mountain area, the White mountains, which high lands constitute the watershed between the Gila and Little Colorado drainage areas. Although the distance is, comparatively speaking, short in a direct line from the sources of the tributaries of these two rivers, the intervening country is very broken and in places is impassable. It is especially desirable from an ethnological point of view to examine whatever ruins may exist in that region, since they may be regarded as frontier settlements of ancient peoples which, with many points in common, have many differences; but the author did not find it possible to do this.

It was, however, possible to take up the problem whether there is a close likeness between the ancient culture of the Upper Gila and that of the people who lived near Phoenix and Tempe. The author went around the White mountains, via the Southern Pacific railroad, and approached the Gila from the south. The section of this valley chosen for archeological study is almost directly south of Pinedale, and is locally known as Pueblo Viejo.

The name Pueblo Viejo is given to a portion of the valley of the Gila from Pima to San José, between Mount Graham and the Bonita mountains, forming the greater part of Graham county, Arizona.

This valley was traversed by the "Army of the West" in 1847, and the attention of Americans was first called to it by the reports of Emory and Johnston, in their "Notes on a Military Reconnoissance," published by Congress shortly afterward. These reports mention the antiquities of the valley, and have remained for fifty years the only available accounts of them. These authors refer to and figure some of the characteristic fragments of pottery, and speak of circular ruins. No remains of circular buildings can now be detected, and the author has grave doubts that the circular form of buildings ever existed in this region. The circular structures were more likely reservoirs.

This valley was probably known to Spanish explorers as far back as the seventeenth, and possibly the sixteenth, century. The com-

monly accepted route of Coronado would have led him to cross the Gila not far from the mouth of its tributary, the San Pedro, where there was a trail to Moqui, and probably also to Zuñi. If, however, as is urged by Dellenbaugh, he took a still more easterly route, and Cibola was situated near the Florida mountains and not at Zuñi, Pueblo Viejo and the Gila river are far to the west of his route.

Documentary history of the Pueblo Viejo in the seventeenth century is practically wanting. None of the great Spanish explorers passed through the valley in this epoch, when the region was entered along the Rio Grande by way of El Paso del Norte.

In the first decade of the eighteenth century there were apparently no rancherias in the Pueblo Viejo valley. The accounts of the several expeditions of Garcés, and contemporary maps, give no indication of inhabited rancherias east of the mouth of the San Pedro, and no mention is made in the diary of this devoted priest of people other than Apaches living on the upper Gila. But the existence of ruins near the mouth of the San Pedro is noted, though it is highly probable that they became such long before that time.

With the advent of Apaches the population of Pueblo Viejo retreated to the west, abandoning their farms one after another, until they came to the Aravapa canyon. Here they may have intermarried with other stocks, and the Sobaipuris of the early years of the eighteenth century probably contained some of their descendants. They or other survivors never returned to their old homes in the rich plains they had abandoned.

Pueblo Viejo was apparently uninhabited by Mexicans or sedentary Indians at the time of the passage of the Army of the West, and the mounds indicating former houses were frequently noticed at that time. Their age was even then a subject of comment.

The appearance of Pueblo Viejo at this time was probably not unlike that of those sections which are not now farmed. A dense growth of mesquite and cactus covered a sandy soil, which in the dry season turned to dust, covering the traveler or hovering in clouds behind him. Most of the larger specimens of mesquite and other trees have long ago been cut down, but the great growth which this tree may have reached can be judged from a few survivors. In places along the bank of the Gila there were clumps of cottonwood trees, some of which even now present a delightful sight to the weary traveler. In the rainy season the river overflowed its banks, flooding the neighboring valley for miles. The river, although fordable in the dry season, was so swollen after rains in the mountains as to be impassable.

The scenic beauties of the valley have not changed since the Indians lived on the Gila banks. The lofty Graham mountain, the black sides of which glisten with streams of water, is a beautiful sight from almost any part of the middle region of the valley. It

is covered in places with tall pines and other trees, and is a grateful place of resort in the hot summer days. The still more picturesque Bonita mountains, with their serrated summits, hem the valley on the opposite side, and north of these is a broken country, almost impassable, yet with ruined cliff houses and other evidences of a former occupation.

The many ruins in the Pueblo Viejo are all of the same type, viz, clusters of rancherías with a central building which may have served as a citadel for defense. Whether any special building was set aside for a ceremonial room or temple is an unanswered question, but there is some evidence that the central building may have sometimes served for that purpose.

Although a number of clusters of mounds were found in Pueblo Viejo, there were two which were specially examined—that at Solomonville, called Epley's ruin, and that at Buena Vista, a short distance higher up the river than San Jose. The limited time which could be spent in this region made the trip scarcely more than a reconnoissance, which it is hoped at some later day to follow up with systematic exploration.

DISTRIBUTION OF RUINS IN PUEBLO VIEJO

In ancient times, when the valley was populated by a sedentary, agricultural race, aboriginal dwellings were thickly scattered over the plain between the left bank of the Gila and the Graham or Pinaleno mountains. These dwellings were high up on the neighboring foothills as well as in the level plain, adjoining the river. In places houses were clustered together, forming a village, but the majority were isolated, dotting the whole valley. A compact, communal town of the pueblo type, such as is met north of the Apache reservation, was not found, and even when the population was concentrated the villages were composed of many clusters of small houses, separated from each other. As a rule, however, in such a cluster one central structure was much larger than the remainder. This centrally placed building, which is shown in the plan of the Buena Vista ruin (plate LXVI), resembles a type common in the Gila, Salado, and Verde valleys, where we find a central house surrounded by many mounds, indicating that a suburban population was settled about it.

The majority of the clusters of mounds which were examined were situated in the plain not far from the river. This choice was evidently advantageous for an agricultural life, and the want of compactness in the houses would seem to indicate that the farmers had not yet been harried and driven to seek shelter from marauding nomad tribes in walled pueblos.

EPLEY'S RUIN

This is the largest ruin in the vicinity of Solomonville, and lies on the outskirts of the town, on the road to San José. From its position it was the most convenient to study, and considerable work was done in the mounds which compose it. The majority of the mounds had, however, been leveled to the surface of the plain by Mr Epley, and as the place is a favorite quarry for adobe makers, their excavations have destroyed most of the ancient walls.

Just back of the Epley farmhouse there still existed (1897) one of the tallest mounds, which had been partially excavated by Mr Adams. The author's party continued his work, but discovered nothing of interest save the walls of rooms, all of which were of great thickness. From the size and position of the cluster the author concluded that it was the remains of the central building or citadel of the group.

The smaller mounds which dotted the farm around it were traced almost to the river bank. The remains of house walls could be discovered in most of these, but excavations in the majority of the rooms developed very little of archeological worth. A few large ollas made of rough ware were taken from the mounds at the eastern end of the farm, but they were all broken. One or two slipper-shaped jars and food bowls of decorated ware were dug from the same rooms. Perhaps the most important objects from Epley's ruin were the skeletons of two infants, buried in the floor, accompanied by mortuary bowls and small vases.

A considerable number of whole bowls and vases were offered for sale by persons, mainly Mexicans, living in the neighborhood. It was reported that these had been taken from Epley's ruin by the adobe makers, and there is no doubt that such was the case.

While the author was at the ruin a party of these laborers unearthed from the level land, a hundred yards east of Epley's house, a decorated vase (plate LXVIII) filled with burnt human bones, which were secured and added to the collections.

It was customary, before the burial of these cinerary urns, to cover the orifice with a circular burnt-clay disk, which was carefully luted in place with adobe. These urns were deposited not far from the pyral mounds, on which the cremation occurred, and were buried only a few feet below the surface of the ground. The adobe diggers reported that they always found a number of these ollas in close approximation, and that burnt bones were generally found within them.

BUENA VISTA

The best preserved of all the mounds in the Pueblo Viejo which were visited is situated at Buena Vista, a few miles east and north of San José, and is probably the ruin which gave the name to the

whole valley; San José being sometimes called San José de Pueblo Viejo. The ruin of Buena Vista is typical of those lower down the river—of the mounds less disturbed by the farmer. Indeed, it is probably in about the condition in which all the ruins were when Emory passed through the valley.

The site of the cluster of mounds of Buena Vista is a high bluff, at the base of which, on one side, flows the Gila river. A few modern adobe houses, inhabited by Mexicans, have been built on the bluff, and some of the ancient walls have apparently been utilized in these modern structures. The largest and most conspicuous ancient building is an irregular stone structure which is situated somewhat back from the edge of the bluff, and is now used for a corral. The walls which composed it have tumbled down, but enough remains to indicate its ancient form. Apparently it was formed of many rooms which were built about a central plaza; stones were extensively used in its construction.

Surrounding this larger stone inclosure there lie at intervals low mounds, some of which betray evidences of rooms, while others are simply ash heaps. Two large circular depressions, a few hundred feet from the central building, are conspicuous. The limits of the cluster of mounds which compose Buena Vista could not easily be determined, and probably no two persons would agree upon their extent. The more prominent, however, are sketched in the accompanying plan (plate LXVI).

It would hardly be consistent to call this cluster of mounds the ruins of a pueblo, as we ordinarily understand the word. They lack compactness and mutual dependence. The houses, save the large central building, are more like farm houses, or isolated buildings, of one story, with a few rooms, inhabited by a single family. They may better be known as rancherías, which have been arranged in a cluster for certain mutual advantages. Among these was probably nearness to a central house which might serve as a place of refuge, or, possibly, for ceremony. The vicinity to the large circular depressions in the ground, which may be interpreted as reservoirs, was also a decided advantage. The presence of small mounds of ashes near the larger mounds containing remains of house walls would seem to indicate that each family had an individual burning place for its pottery. Possibly the dead were cremated on these mounds, which accounts for the absence of cemeteries, and for the ollas with calcined human bones sometimes found buried in them.

Architecturally there is very little likeness between this central large stone inclosure or house with many rooms and Casa Grande, the best-known building of the Casa Grande group. This difference is in part due to the character of the building material, but more to the plan of the building itself.^a The large central stone structure of

^a From Mindeleff's valuable description of the Casa Grande group of ruins it appears that Casa Grande was neither central nor the largest structure in the cluster of buildings.

Buena Vista is more like those north of the White mountains and resembles closely the rectangular ruin at Pinedale. We have in the Buena Vista ruin resemblances to both the lower Gila ruins and those of the southern tributaries of the upper Little Colorado.

Thus far in his archeological studies the author has failed to find in the belt of Arizona ruins from Sikyatki south to the Gila any rooms which he can positively identify as kivas or ceremonial chambers. As is well known, however, each of the modern Hopi pueblos has one or more of these rooms, though some of the important secret ceremonies in the modern Hopi pueblos are performed not in special kivas, but in the oldest homes of the clans.

There was no room found in the Pueblo Viejo ruins which could be called a special ceremonial room, and in the large ruins at Cheylon, Homolobi, and Chaves no undoubted kivas were found. The room described in the preceding account of Four-mile ruin may, however, be regarded as a ceremonial chamber. The kiva, as we now find it in Tusayan, is a late innovation, and was probably introduced from the eastern pueblos. Its existence in Four-mile ruin may be accounted for by the position of this ruin.

OTHER RUINS

Many objects of pottery have been dug up near the San José settlement, and there are one or two mounds near by indicative of ancient dwellings. If there ever was a large cluster of mounds on the present site of the town, they have been wholly obliterated by its inhabitants.

There is a mound of some size on the right bank of the irrigating ditch, just as one enters the town from Solomonville, but one side of it has been worn away by freshets from the San Simon. It serves as a protection for the neighboring farm, which lies between it and the river, and on that account the owner refused to allow it to be dug away. A few days' labor at this ruin would bring to light objects of archeological value, for a beautiful vase rewarded an hour's superficial scratching of the exposed bank. One of the finest ollas obtained from the Pueblo Viejo was purchased from a San José man, who dug it out of this mound while working at Buena Vista. As charred human bones were found in it, this vase, figured in plate LXIX *c*, is regarded as a cinerary urn.

There were formerly several mounds indicating ruins near Thacher, but these have been mostly leveled and can not now be traced. A number of mounds are still visible at Mr D. Olney's ranch, and lines of stones, the foundations of ancient walls, can still be traced in the road in front of Mr Lem Place's house. The large mounds on Mr Peter Anderson's farm have been destroyed, and there are many others near it which have met the same fate. It may be said that in ancient times the houses of the aborigines dotted the valley through-

out its entire length, from Buena Vista to Pima, and the indications are that the population was larger and had a greater number of acres of land under cultivation than at the present time.

In a valley which was so densely populated we should expect to find a large number of antiquities, stone implements, ollas, and other forms of pottery. From all that can be learned comparatively few specimens have been dug out of the ground, although there are several private collections of some size. Different farmers have told the author of plowing off the necks of rows of buried vessels, and workmen on the irrigating ditches report finding pottery in abundance in several places far from mounds; but the large majority of relics are still under ground, and probably will remain there for years to come, now that the fields above them are cultivated. The only collections of any size which have found their way to public institutions, and are therefore available for study, are one of a few specimens in Tucson and that which was brought back to the National Museum.

CHANGES IN THE VALLEY SINCE 1847

Great changes have been wrought in the appearance of Pueblo Viejo since Emory passed through it in 1846, for if any white man lived there at that time he says nothing about him. There were evidently no settlements, for he wrote:

Everywhere there were marks of flowing water, yet vegetation was so scarce and crisp that it would be difficult to imagine a drop of water had fallen since last winter. . . . The dust was knee-deep in the rear of our trail; the soil appeared good, but for whole acres not a sign of vegetation was to be seen. Grass was at long intervals, and, when found, burnt to a cinder.

In a prophetic way he added:

The whole plain, from 3 to 6 miles wide, is within the level of the Gila, and might easily be irrigated, as it no doubt was by the tenants of these ruined houses."

Ancient mounds, in much the same condition as those in Pueblo Viejo formerly were in, still remain in the long stretch of country between Geronimo and Dudleyville, across the southwestern corner of the Apache reservation, wherever there are plains along the Gila, but white settlers have worked marvels in other parts of the valley, which may now be said, using a familiar simile, to "blossom as the rose." At present Pueblo Viejo, from Buena Vista to Pima, which towns mark the limits of the author's acquaintance with it, is one succession of cultivated farms of corn, alfalfa, and melons, a garden of Arizona in which any crop can be raised.

It seems incredible that in fifty years such great changes should have taken place, yet it was to be expected, for in prehistoric times

^aNotes of a Military Reconnoissance, Washington, 1848, p. 68.

Pueblo Viejo was a garden spot, and there is every reason to believe that when it was inhabited by aboriginal farmers more acres of its land were under cultivation than at present.

FORMER POPULATION OF THE VALLEY

If we judge from the number of ruins, the capacity of ancient reservoirs, and the size of irrigating ditches, the extent of the terraced gardens, and other evidences of aboriginal agriculture, Pueblo Viejo was formerly densely populated. To be sure, there is no proof that all the ancient buildings were simultaneously inhabited, and, on the other hand, there is no reason to suppose that they were not.

The aboriginal population was not huddled into a few beehive pueblos for protection, but was spread over the plains in small rancherias, or farming hamlets, dotting the valley from one end to the other. The evidences of the large ancient population are, however, rapidly disappearing, and in a few years will have completely vanished.

CREMATION OF THE DEAD

There were apparently two methods of disposing of the dead practiced by the ancient people of the Pueblo Viejo ruins, viz, house-burial and cremation.

Evidences of the former method were found at Epley's ruin and at Buena Vista, and the same are reported from the ruins near Thaeher and elsewhere. The skeletons found in house-burials at Epley's ruin were mostly those of infants, and were accompanied with mortuary food vessels and bowls, generally rude ware. It was also common to find metates in the neighborhood of such interments in such positions as to indicate that they were placed there by design.

Evidences of cremation were common, consisting of calcined human bones in mortuary ollas, with ashes, evidently of bones, buried on certain low mounds adjoining the houses. It was apparently the ancient custom to burn the dead on certain pyral mounds and then to gather up the remains of the burnt bones and deposit them in small rudely decorated vases. A circular disk made of pottery was luted to the orifice of these vases and the whole was buried in an upright position near the edge of the mound upon which the burning took place. In its neighborhood there were also placed jars or other mortuary objects, as in the case of intramural interments.

This method of disposing of the dead is similar to that adopted by the ancient people of the great ruins of the Gila-Salado region, adding one more indication of a close resemblance between the ancient inhabitants of the Pueblo Viejo and those lower down the Gila river.

There survive among aboriginal people of the Gila-Salt valley two distinct forms of disposal of the dead, burial and cremation. The

fact that some of the tribes in this region burned their dead and that others did not was mentioned by historians in the middle of the fifteenth century, and it would seem possible that here we have evidences of two distinct stocks in the valley. These two stocks had partially consolidated, forming a people which built the great houses. Certain clans of the compound stock, like their ancestors, cremated the dead; others interred their deceased. The custom of burning the dead does not appear to have been carried into the Little Colorado valley.

In this connection, statements of Castañeda that the Cibolans burned their dead is instructive. The author has not, however, discovered north of the Mogollones any archaeological evidences of cremation, and is unaware of any well-authenticated statement that they have been found in any Zuñi ruin. The suggestion that the present Zuñians in mortuary customs perform certain ceremonies which symbolize burning the dead has been given some weight, but this might be interpreted as a survival transmitted to modern times by clans who came from the south. Our knowledge of the nature of this reported Zuñi survival is very vague.

ARCHITECTURE

The houses of Pueblo Viejo are arranged somewhat differently from those of the Little Colorado and its tributaries. The tendency in the latter regions is toward consolidation, toward a close approximation into a communal pueblo, while the buildings in the Pueblo Viejo are more like rancherias or farm dwellings. Each of the houses was small, apparently inhabited by a single clan, and they were generally grouped in clusters, which may for convenience be styled villages.

There is generally found in the midst of, or near, such a cluster of small houses, a larger building which occupied the relation of a citadel, or, possibly, a ceremonial room; it may be single or composed of several chambers. This feature can be well seen in the accompanying plan (plate LXVI) of the Buena Vista ruin, one of the least changed of those in the Pueblo Viejo. The existence of a central room with clusters of small houses near or about it reminds one of the Casa Grande group near Florence, Arizona.

There is no region of the Southwest from which better examples of the influence of environment on architecture can be cited than in the Gila valley. The majority of houses in portions of the valley where stones are absent were built of adobe, while in the upper part of the river valley, where rock is more abundant, we find that the inhabitants utilized it as a building material. Thus, while adobe forms the greater part of the walls of Casa Grande, the great central room of Buena Vista was constructed of rock.

In the majority of houses in Pueblo Viejo there were three building materials employed in the walls, namely, stones, adobe, and logs.

River-worn stones arranged in rows are in many places all that remain of the ancient walls of rooms. It would seem that they formerly served as foundations, and were sometimes inserted in the sides of the house, but in neither case were they closely fitted together. They imparted a certain solidity to the walls, and, when used in foundations, prevented erosion at a weak point in its structure. No attempt to dress these stones, or, indeed, to break them, was noticed, but they were laid together with clay—the main building material employed.

There were many and conclusive evidences that logs were employed in the construction of the house walls. These logs were driven upright along the lines of the foundations at short intervals, and gave strength to the walls and support to a roof which covered the chamber. The spaces between them were filled in with stone and adobe.

In the early accounts of the ancient habitations of Pueblo Viejo by Emory and Johnston mention is made of these logs, and many of them were still standing in place when the Army of the West passed through the valley in 1847. Old residents of San José say that when they first took up their abode in the place the upright logs in some of the Buena Vista house-clusters were still visible. Only a few now remain above ground, yet the bases of several were discovered by the author's excavations.

The rapid disappearance of these logs can doubtless be partly explained by their use as fuel. For years the mines in the neighborhood employed laborers cutting firewood, and the large mesquite bushes were used for that purpose. No doubt the logs of the early buildings were among the first gathered by them.

TERRACED GARDENS

Students of Southwestern archeology are familiar with rows of stones marking off the surface of the land in rectangles of great regularity. Some of these lines of stones extend for several hundred feet. They occur on level mesa tops or on side hills, but there is rarely any broken pottery or other evidences of human habitation about them. Various interpretations have been advanced to account for these regular rows of stones. By some authorities they are supposed to be the remains of house walls, or foundations of the same, and as such they are commonly pointed out to the visitor. Miudeleff speaks of them as "boulder sites," and describes many from the Verde valley. Similar boulder sites are very abundant, especially on the sides of the mesa bounding Pueblo Viejo, in the San Simon valley; probably a correct interpretation of them in these localities

would equally well apply to other boulder sites, as, for instance, those of the Verde valley.

The arrangement and size, and absence of remains of human life near these lines of bowlders have led the author to abandon the commonly accepted theory that they have relationship to house walls, or, indeed, to habitations of any kind. The small size of the bowlders employed shows that they are not fortifications, and they should not be confounded with trincheras or fortified hilltops so common in southern Arizona and northern Mexico. They may be regarded rather as the walls of terraced gardens, so placed as to divide different patches of cultivated soil, or to prevent this soil from being washed down to the plain below.

Very extensive terraced gardens may be seen not far from San José, and all along the mesa near the Solomonville slaughterhouse. It would seem from their distribution that not only irrigation ditches watered the valley of Pueblo Viejo, but also that water was in some way carried up the hillsides, so that land now barren was in ancient times cultivated by the people of this region.

As no remains of rancherías were found near some of these terraced gardens, it is evident that the farmers who tilled them had to go a considerable distance from their homes to plant and harvest their crops.

The use of terraced gardens still survives among the modern Hopi Indians, and these structures may still be seen on their reservation, at Wipo and Kanelba on the East mesa, as well as on the Middle mesa and at Oraibi. The size of the gardens on the East mesa is much less at the present day than in former times; those which have been abandoned closely resemble the rectangles inclosed by lines of stones in the Verde and Gila valleys.

PREHISTORIC IRRIGATION IN PUEBLO VIEJO

There are evidences that the ancient farmers of the Pueblo Viejo irrigated their farms, for remains of extensive aboriginal ditches can be seen at several points. These old canals are clearly visible in that part of the valley which is not at present cultivated, but traces of them have naturally disappeared before the plow of the white settler. The remains of large circular reservoirs can be readily traced near some of the house clusters of Buena Vista, and not far from Epley's ruin, where there is a reservoir from which was undoubtedly drawn the water supply of that neighborhood. At the time of the author's visit this reservoir was full of water, which was used on the farm.

The modern acequias, the San José and Montezuma ditches, follow in part of their courses the ancient canals, as the author has been informed by an old settler in Solomonville; and a section of a side canal at right angles to the Gila may still (1897) be traced near San José.

There can hardly be a doubt that water was carried in large earthen vessels to some of the terraced gardens, the altitude of which above the water in the river would make irrigation otherwise impossible. The surface of the land near the banks of the stream is continually shifting, on account of erosion due to heavy freshets and overflow of the river banks. On this account many of the ancient canals have been filled with soil, or their banks washed down to the level of the surrounding plain.

POTTERY FROM PUEBLO VIEJO

The pottery from the Pueblo Viejo ruins is identical with that from lower down the Gila river, at Phoenix and Tempe. It differs very markedly from that of the White mountains.

COLOR AND SURFACE FINISH

As a rule the Gila pottery is coarse, and the decoration is simple, consisting mostly of rectangular geometrical designs. It may be considered under the following types: 1, undecorated rough ware; 2, decorated rough ware; 3, undecorated red ware; 4, decorated black and white ware; 5, decorated gray ware.

UNDECORATED ROUGH WARE

The larger ollas found in excavated rooms are almost always made of a rough coiled or indented ware of coarsest manufacture. These were capacious enough to contain several gallons of water, and were apparently used for that purpose. The exteriors of many were blackened with soot, as though they had been used for cooking, as is at present the custom among the Pueblo Indians.

Most of the large specimens of this rough ware were broken, apparently by the falling of walls or other débris upon them. It may also be mentioned that they were almost universally found in houses, and that one contained the skeleton of an infant.

Small rough-ware vessels also occur, broken or entire (see plate LXVII). The author has limited this group to those specimens of pottery of rough ware in which there is no shining black slip on the inner surface. No food vessels of rough ware were found, but all specimens of this form, of which there were many, had a polished black interior, and belong to the second group.

DECORATED ROUGH WARE

In this group are placed those food vessels in which the interior is covered with a black slip, which reminds one of the modern ware of Santa Clara pueblo. As will be seen by consulting a plate showing this type (plate LXVII), there is some variation in the arrangement of the indentations and coiling in this ware, but no color decoration was attempted. Bowls of this kind are often rubbed smooth on the outer surface, but decoration by indentation or coiling is common.

UNDECORATED RED WARE

A number of pieces of pottery of bright red color, made of coarse paste, were found in the Pueblo Viejo ruins. These were smoothly polished on the exterior, but as a rule were not decorated. In general appearance they resemble the ware still made by the Papago Indians, and they were commonly large, narrow-mouthed vases. This kind of ware was found to be abundant in caves where sacrificial vessels were found. Disks made of it often cover cinerary vases.

DECORATED BLACK AND WHITE WARE

The white ware with black decorations, generally in geometrical designs, was sparingly represented in the Pueblo Viejo ruins, which is in marked contrast to its prominence in cliff houses near the sources of the Gila in New Mexico. This ware is so rare in the vicinity of San José that the author is inclined to regard it as intrusive in that region.

None of the specimens found are at all comparable in the wealth of their ornamental designs with similar ware from ruins in the western part of Socorro county, New Mexico,^a or in the cliff houses near the sources of the Gila and Salado rivers.

DECORATED GRAY WARE

The characteristic decorated ware of the Gila valley and its tributaries is grayish and is decorated with red; a specimen is shown in plate LXVIII. With the exception of a few sporadic specimens which have been transported to pueblos, now ruins, north of the White mountains, this ware has not been found in any valley except those of the Gila and its tributaries.

This pottery bears a smooth polish, is never glazed, and is generally decorated with geometrical figures: scrolls, terraces, stars, and key patterns. It assumes a great variety of shapes, and was apparently used in much the same way as is the yellow or red ware of northern Arizona.

DECORATION

The decoration of the pottery from this region is mainly in geometrical patterns, resembling that of the pottery from the Little Colorado basin. No specimen with picture writing was found, so that this source of information regarding the mythology of the owners is practically wanting. Even pictures of birds, so common north of the Mogollones, are absent. The ancient people of the Pueblo Viejo had not carried pottery decoration beyond the geometrical stage, as far as can be judged from the specimens examined. Food bowls, almost identical

^a The beautiful collections made in this region by Mr H. Hales are now preserved in the National Museum, and are well worth study and description. For an account of the ruins near Tulerosa see N. Francis Duff, *The Prehistoric Ruins of the Rio Tulerosa*, in *Bulletin of the American Geographical Society*, v. 29, n. 3, 1897.

in form with those of Tusayan, have their interiors decorated with rectangular patterns, sometimes with terrace figures, but rarely with spirals. Encircling bands are often broken at one point, forming "life lines," and zigzag lines are not uncommon. Few specimens with external decorations were found. Vases were generally decorated with the same simple geometrical patterns as were the food bowls, with no attempt to depict human or animal forms. It is unfortunate for the student of Gila valley ceramics that pictographic material is so scanty, as it shuts him out from most instructive data regarding ancient life in this part of Arizona.

A finely made human head, forming the handle of a ladle, was dug out of an ash heap in the Buena Vista ruin. This was the only

handle modeled in human form which was found, though objects of of this kind are said to be common lower down the Gila river. A like ornamentation is not a rare feature of ladle handles from the Little Colorado ruins.

The broken encircling band, called the "line of life," occurs on many of the decorated pieces of pottery, and the H figure, so common on the exterior of bowls north of the mountains, was found on a single fragment of pottery from Pueblo Viejo.



FIG. 111. Moccasin-shaped jar from Pueblo Viejo.

Another specimen from the Pueblo Viejo, in which the likeness to an Indian moccasin is close, is shown in figure 111. The specimen is, however, much smaller than a human foot.

The accompanying illustration, plate LXVIII, shows two views of one of the most richly decorated vases from the Pueblo Viejo, and exhibits several of the commoner geometrical designs from the Gila ruins. This vase was dug up near San José, and was probably a cin-



FIG. 110. Decorated slipper jar from Pueblo Viejo (number 177533).

There were a few specimens of clay slippers which were ornamented on their upper side. One of these is shown in the accompanying cut (figure 110), in which the design of the decoration can be partially seen. It is not improbable that the "foot of an idol," mentioned by Emory and his officers, was one of these slipper jars.

erary olla, as it contained, when found, cinerated human bones. The ware is characteristic of the Gila, though a few straggling specimens of similar pottery have been found at Four-mile ruin near Snowflake. It will be observed that the decoration of this vase is wholly in geometrical patterns, a common feature of all ornamented ware from the Pueblo Viejo. Almost all geometrical forms are represented—spirals, bars, terraces, stars, and squares with dots.

In plate LXIX other forms of decorated ware from Pueblo Viejo are represented. Figure *a* shows a small saucer, with exterior and

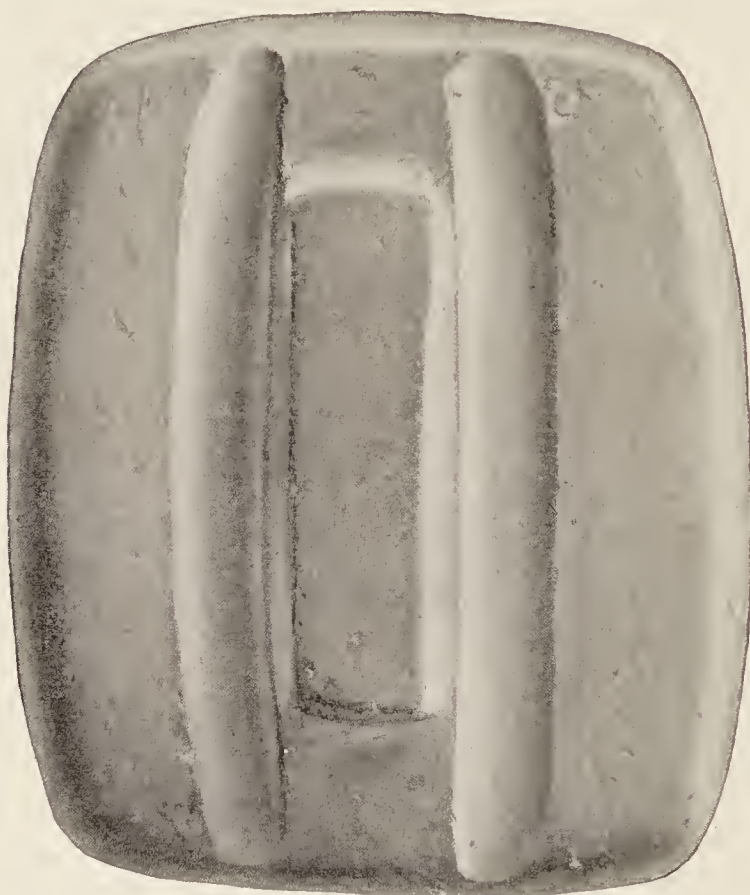


FIG. 112. Arrow polisher from Pueblo Viejo (number 177569).

interior decoration of rectangular bands of black; the margin is white. Figure *b* shows a small vase of typical Gila pottery, ornamented with zigzag red bands, which was excavated from the Buena Vista ruin. The vase *c* was dug out of the flat near the western mounds of Epley's ruin. It was found by Mexican laborers making adobes, and contained a calcined human skeleton. The external surface of this vase was smooth, and the decoration consisted of series of terraced figures, recalling those geometrical designs so prominent in all ancient pottery from Arizona.

STONE OBJECTS FROM PUEBLO VIEJO

IMPLEMENTS

The ancient people of Pueblo Viejo were still in the stone age, and their implements were similar to those found elsewhere in the Southwest. The stone hatchets are, as a rule, finely made, as is generally the case in the Gila and Salt river ruins. A considerable number were collected, some of which were among the finest known to the author. They were, however, identical with stone implements that have already been collected in other parts of Arizona. There was nothing strikingly peculiar in the arrow and spear points collected in this region. The stone axes were finely polished and very numerous. There were many hammer stones, pounders, rubbing stones, stone knives, and drills.

Although nothing distinctive was noticed in the arrowheads, a fine collection of these implements made of volcanic glass, from the cave in the Nantacks hereafter discussed, should be mentioned. A number of spherical stones, varying from the size of the fist to that of a large marble, were picked up on the surface of the mounds. Some of these may belong to a type of stone objects referred to in early accounts as being used by the people in warfare. They are thus mentioned by Castañeda: "Farther off was another large village, where we found in the court-yards a great number of stone balls of the size of a leather bag containing one arroba. They seem to have been cast with the aid of machines, and to have been employed in the destruction of the village." What the nature of this machine was we are not told, but it was possibly a kind of sling. Problematic stone disks with depressed faces and circular forms are not rare. Simple stone disks of the same shape, but perforated, may once have been attached to drills. There were pottery disks which were supposed to have had a like use.

Arrow polishers (figures 112, 113) or grooved stones for rubbing down wooden sticks occur in numbers. The depressions in some of these were so smooth that their efficiency in grinding must have been small, while in general shape and size they correspond so closely with those stones which are still used for that purpose that there can be little question as to their use.

A large number of metates, or stones for grinding corn, were collected in the excavations at Epley's ruin. These were made of several kinds of rock, the favorite being lava or malpais. Evidences of long



FIG. 113. Arrow polisher from Pueblo Viejo.

use can be seen in the deep depression which has been ground into them, even when the rock was very hard.

The form of metate with three legs (figure 114) is more Mexican than any which was found north of the White mountains or in the Little Colorado valley, and is not unlike rude specimens from Central America.

Small stones with a regular depression in one face were used for



FIG. 114. Metate from Pueblo Viejo (number 177471).

grinding pigments, and the remnants of color were still found on them. Green, red, yellow, and white pigments such as are still used by the Pueblo Indians were found in many of the rooms. Oblong or oval stones, with a flat face, worn on one pole, served as rubbing

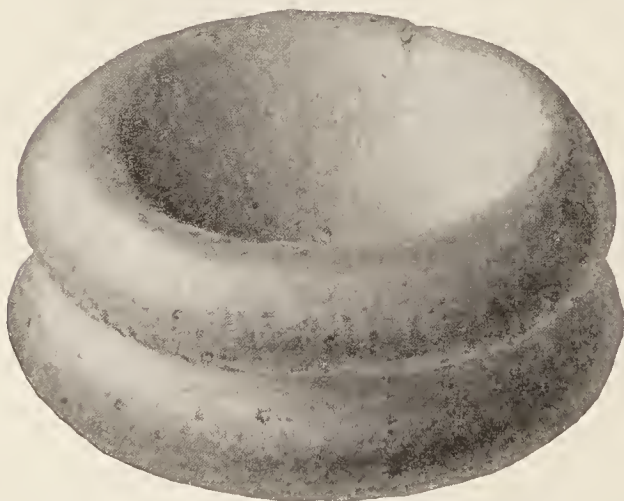


FIG. 115. Unknown stone object from Pueblo Viejo (number 177677).

stones by which these substances were ground to powder. There was sometimes considerable skill shown in the way these stones were fashioned. They were sometimes mushroom-shaped, with a circular disk and a slim handle.

One of the finest wrought of all the mortars was purchased from a Mexican in Solomonville. It was elongated, trencher-shaped, with knobs at the extremities.

The rock of which it was made, though very hard, was worked with considerable skill. The Mexican who sold it had used it for bruising vegetable substances. No doubt this is but a continuation of its use in prehistoric time, long before white men came into the country.

The author saw a beautiful mortar^a made of a green stone, which

^a Attempts to purchase this fine specimen failed.

was said to have been taken out of the ruins near Solomonville. This was one of the finest paint mortars which he ever saw from the Southwest.

One of the most exceptional of stone objects from the Pueblo Viejo ruins is shown in the annexed cut (figure 115). It has a regular disk form, and is carefully worked from a lava stone. The form is that of a paint mortar.

STONE SLABS

Early in the author's studies in the Pueblo Viejo, his attention was called to a stone slab shaped like the sole of a shoe (figure 116), to which it was compared by the Mexican who owned it. This object



FIG. 116. Ceremonial stone slab from Pueblo Viejo (number 177575).

was flat or slightly convex on one face, flat on the opposite, and had a shallow groove on the margin. The border on the flat side was ornamented with a number of parallel scratches arranged in clusters.

Later the author obtained other stones of the same shape and of about the same size; one of the most instructive was a specimen of irregularly rectangular form, with a bird's head carved on one edge, and the tail on the other (figure 117).

There is an interesting modification of the same class of objects in the collections of the National Museum—a circular stone slab of which the body of a snake, with head and tail skillfully carved, forms the margin. These objects, which are not rare in the ruins of the Gila and Salt river valleys, are called ceremonial slabs, and were probably used in much the same way as are the stone slabs orna-

mented with designs which have been repeatedly described from Hopi altars. In fact, some of those now in use distinctly resemble those from the Pueblo Viejo.

OTHER STONE OBJECTS

It was interesting to find in the ruins of the Pueblo Viejo a number of obsidian nodules, and flakes of the same material. Fragments of



FIG. 117. Ceremonial stone slab from Pueblo Viejo (number 177578).

volcanic glass constantly occur in ruins north of the mountains, along the Little Colorado, and at Sikyatki.

The fact that over a dozen specimens of quartz crystals were found shows that these objects were prized, and were probably used in cere-

monials, as is the custom in modern pueblos.

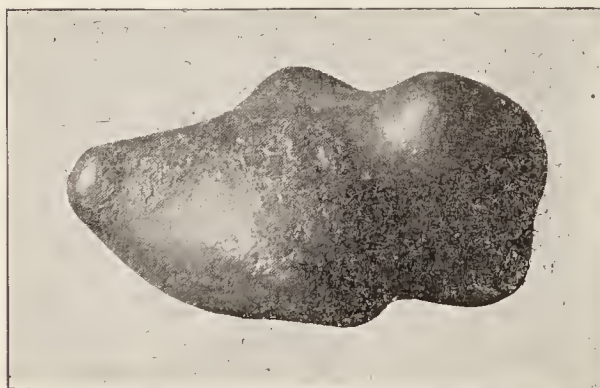


FIG. 118 Stone fetish from Pueblo Viejo.

Perforated circular stones, varying in size from that of a silver dollar to several inches in diameter, were found, while similar disks made of pottery were common. Many of the latter were not perforated. Their form suggested that they were used in gaming.

These disks occur along the whole length of the Gila river, and are also found more sparingly in ruins north of the Mogollon mountains.

The ancient inhabitants of the Pueblo Viejo villages prized for ceremonial purposes stones of curious or strange shape, especially those which were botryoidal. One of the most striking of these is shown in the accompanying cut (figure 118). It is typical of several which were found in the San José ruin, at Buena Vista, and near Solomonville.

SHELL ORNAMENTS FROM PUEBLO VIEJO

Several specimens, generally ornaments, carved out of *Haliotis*, *Conus*, or *Pectunculus* shells, were collected in the Pueblo Viejo ruins. The largest of these were armlets and wristlets. Shells cut in the form of animals are among the characteristic objects of the Gila-Salado ruins, and occur in all great collections from this region. We find various animals represented, as lizards, birds, rabbits, and snakes, as well as circles, crosses, rectangles, and the like. They are ordinarily perforated—generally at the eye, sometimes at the heart, of the animal represented. The universality of this perforation implies suspension, and the author believes that it will later be found that they were worn on the neck or body. It is not improbable that they were personal fetishes, possibly representing totems.

CLIFF HOUSES ON BONITA CREEK

There are many cliff houses and other ruins of aboriginal dwellings in a fair state of preservation along Bonita creek, 18 miles north of Solomonville. A very good account of these, written by Professor William Stone Devol, of Tucson, has been published, with a half-tone illustration, in the Graham County Bulletin. These remains would repay more extensive study and no doubt yield collections of considerable archeological value. These cliff houses resemble in general character those near Silver City, New Mexico.

RUINS IN THE FOOT HILLS OF MOUNT GRAHAM

There are many ruins, mostly small, on the mesas and foot hills of Mount Graham, having the same general character as those lower down the valley, near the river. The fragments of pottery strewn about upon them are identical with those from the mounds of the plain, and there is reason to believe they were made by the same people. While these ruins occur at several places on the mesa and hills at the base of Mount Graham, that at the place called Cienega is one of the largest, but it does not differ radically from those of the banks of the Gila.

SACRIFICIAL CAVES

The use of caves for ceremonial purposes was a feature in the life of the ancient people of Pueblo Viejo. The mountains near the Pueblo Viejo have many caves suitable for this purpose. They occur in limited number near the modern Hopi pueblos and elsewhere north of the Mogollones.

The author visited one of these sacrificial caves in the Graham mountains, and found many evidences of its former ceremonial use. There were bushels of prayer sticks on the floor, and a few fragments of basketry, but no pottery or earthenware rewarded the search.

The fragments of basketry were made with a technique similar to that of the basket plaques of the Middle mesa. The prayer sticks were painted red at their extremities, and were, as a rule, about the size of a penholder. This cave, called Adams' cave, has been rarely visited since its discovery by Mr B. B. Adams, of Solomonville, but will well repay a visit by an archeologist. There is little doubt that there are other similar caves on the northern side of the Graham mountains which have not been entered by white men.

COLLECTIONS FROM A CAVE IN THE NANTACKS

In the broken, almost inaccessible, country north of Pueblo Viejo, there are many caves, some of which are quite extensive. The larger and more open were utilized by ancient builders in the construction of cliff houses. Many caves in this region have narrow entrances into passages which extend with many ramifications far into the bowels of the earth. The nature of the objects found in most of them shows that the caves were not inhabited, but were resorted to for purposes



FIG. 119. Indented bowl from a cave in the Nantacks (number 177458).

of prayer and sacrifice by a sedentary people akin to that which has left so many ruined houses in the Southwest.

A few years ago some young men from Pima, a settlement in the Pueblo Viejo, explored one of the caves in this region, and obtained from it a collection of some size and considerable archeological interest.

The attention of the author was called to this collection early in the summer of 1897, and in September he visited Pima, and secured many of the objects for the National Museum.

The collection has been divided by those who obtained it into four parts, one of which had been sent to Utah; another was owned by a man who did not care to sell. The other two parts, numbering almost 100 specimens, were purchased. They contain all the typical forms of the other two, and a few specimens which were unique.

All the specimens were small votive offerings, but those who had entered the cave declared that they left behind all fragments, of which there were many, so that we may suppose that there were larger vessels thus abandoned. The specimens were, as a rule, rough ware pottery (see figure 119), smooth, undecorated red ware, turquoises, arrowheads, fragments of marine shells, and white pigments.

A large number of clay disks occur in the collections. These were not unlike similar formed objects which were found at Epley's ruin, and probably were originally fitted to the orifice of the small vases in much the same way.

There were globular vases (see figure 120), one of which had two perforated tubercles, one on each side of a small orifice. These

remind one of those vessels in which sacred water is carried in ceremonies among the Pueblos.

Another small globular vase had the whole exterior covered with indented tubercles, not perforated but evidently ornamental. This type has been found in some of the Little Colorado ruins. A long tube with similar tubercles over its surface, made of rough pottery, may have been an ancient pipe or cloud-blower. Neither of these objects had designs painted upon them.

From the great quantity of turquoise beads and obsidian arrow-points it would appear that large numbers of these objects were scattered over the floor of the cave. As the collectors exercised no special care to gather everything which they saw, no doubt the quantity of these objects could be much increased by a reexamination of the cave.

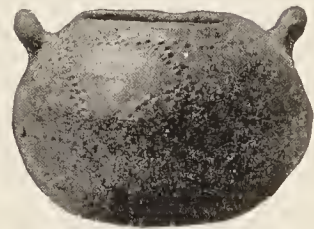


FIG. 120. Small amphora from a cave in the Nantacks (number 177463).

EFFIGY VASES FROM SOUTHERN ARIZONA

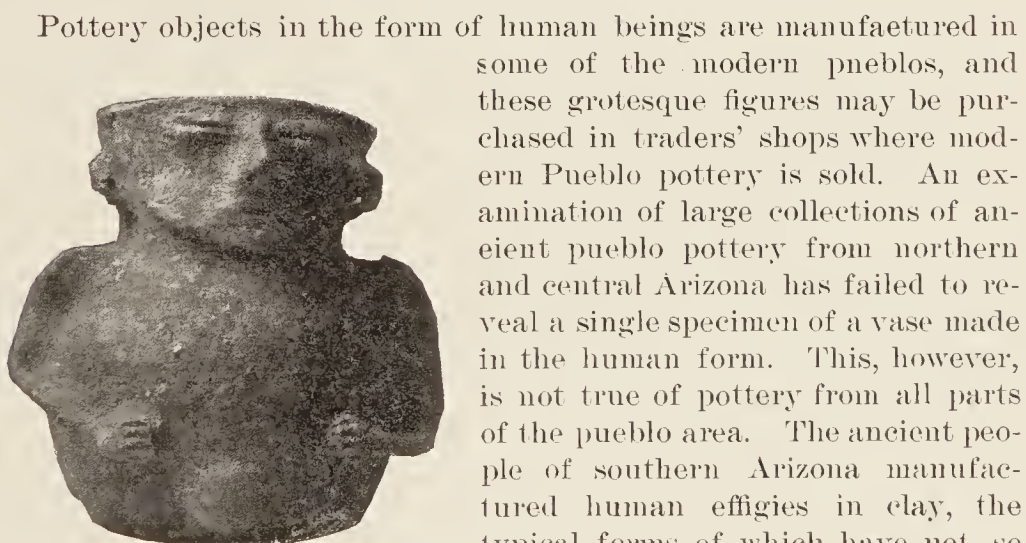


FIG. 121. Human effigy vase from a cave in the Nantacks (number 177519).

Pottery objects in the form of human beings are manufactured in some of the modern pueblos, and these grotesque figures may be purchased in traders' shops where modern Pueblo pottery is sold. An examination of large collections of ancient pueblo pottery from northern and central Arizona has failed to reveal a single specimen of a vase made in the human form. This, however, is not true of pottery from all parts of the pueblo area. The ancient people of southern Arizona manufactured human effigies in clay, the typical forms of which have not, so far as is known, been described. The particular interest attached to the

vases here described, which justifies calling them into prominence by special mention, is due to the rarity of this type in ancient pueblo collections, its reappearance in certain vases from Arkansas, and its common occurrence in the northern States of old Mexico. The accompanying illustration (figure 121) shows one of these vases from the cave in the Nantacks mentioned above. It is made of coarse material and has a rough exterior, with patches of a calcareous deposit on the surface. This deposit of lime is found in greater or less amount on most of the specimens from this cave, and was deposited on them by water charged with lime percolating from the rocks

in which the eave was formed. Attempts to rub off this film are evident in some places; but elsewhere, as under the right eye, considerable patches remain, probably concealing symbols on the right cheek.

The head is marked off by a constriction representing the neck, and the eyes, nose, mouth, chin, and ears are well represented. As is generally the case with idols of stone, wood, or clay from the pueblo region, the details of the head are better represented than those of the body or limbs.

No attempt was made in this vase to represent the legs, and the arms are simply irregular ridges, one on each side of the body. The shape of the body is irregularly globular; the base is flat. The vase is of about uniform thickness, the outlines of its cavity conforming in a very general way with the elevations and depressions of the outer surface.

The author supposes that this vase was filled with votive offerings when it was placed in the eave, and that in course of time its contents were washed out. The nature of the offerings may be conjectured from the fragments of shells, turquoises, and other objects reported as strewn about the floor of the eavern.

The short parallel lines painted with white pigment under the eyes are worthy of a passing notice. These are the only symbols on the face, and consist of a few short lines extending downward from the lower eyelids. If the reader will examine the collection of Zuñi dolls which are exhibited in the "Pottery Court" of the National Museum, now installed, he will find one labeled Zuñi Hehea kateina,^a which has the same markings on the cheeks as has the effigy vase from the Nantaeks.

It is instructive to note the similarities of this effigy vase with those from Casas Grandes, Mexico, and from Central America, which are so close that the vase might readily be mistaken for an illustration of a type from northern Mexico or even Central America.

It appears that while this vase has a form unknown in collections of ancient pottery from ruins along the Little Colorado and its tributaries, it is not unique in those from the Gila-Salado watershed.

The lesson taught by the presence of this effigy vase in the Nantaeks and the Gila-Salado basin and the absence of similar forms north of the Mogollones may be summed up in two words, "Mexican influence." The distribution of this form of Mexican ceramics did not cease at what is now the southern frontier of Arizona, but extended to ruins along the Gila valley and its tributaries high up into the highlands to the north, where these streams rise. As far as is known, this was the most northern extension of this particular form of ceramic technique in Arizona. Southward from this locality the relative number of

^aHehea kateina is a Hopi name, and the doll representing this person at Walpi has not the same markings on the face as the above. The Hopi variant has parallel zigzag lines above both eyes and on the cheeks. The name given above is that by which the Zuñi doll is known to the Hopis.

human effigy vases increases, until they become very common in Chiapas and Oaxaca. But, it may be urged, why is it necessary to interpret this form as due to Mexican influence? The advocate of the independent evolution of technology will doubtless say that the manufacture of a human effigy vase is no great trick and had been evolved independently again and again in different regions of aboriginal United States. Some clever potter of the Nantacks, it may be said, invented this form. Why, it might be asked in reply, did not the potters north of the Mogollones also invent the same form? for they were equally skilled, and their ceramic ware was more variegated and elaborate. What explanation is offered on the theory of independent invention of the increase in the relative number of effigy vases as we go south?

It seems probable that the presence of human effigy vases in southern Arizona and their absence in the northern part of the Territory is in harmony with a theory of the influence of Mexican art in the former region. While recognizing the potency of this influence in southern Arizona, we are not necessarily called upon to accept a connection among all potters who have made human effigy vases, or even between those of ancient Arkansas and Chihuahua, whose effigy products have some similarity.

There are many like ceramic forms and decorations among different people, invented independently, and there is no reason to doubt that human effigies in the form of vases were so invented in several well-known instances. There are also cases where identity in form and symbol can better be explained by barter. Possibly the effigy vase described above belongs to the latter category. It would be premature to build conclusions on a single specimen, and more information regarding the distribution of ancient human effigy vases in the Southwest is desired. These vases have not yet been found in Arizona north of the White mountains, but they are represented from several localities in the south. The question awaiting answer is, What is their northernmost extension?

An effigy vase found near San José (figure 122) is instructive as recalling a kind of pottery common in the northern Mexican states.



FIG. 122. Effigy vase from Pueblo Viejo (number 177332).

This piece was brought for sale by a workman, who declared that he had dug it up at San José. The author was at first inclined to believe that it was not found in Pueblo Viejo valley, but critical examination of the ware convinced him that the testimony of the man who brought it could be trusted. It is made of coarse red ware, like other vessels from this locality, and is undecorated. It is shaped like a dumbbell, and the two parts are of unequal diameter. The remarkable thing about this vase is the human nose and ears, in relief, reproduced several times on its sides. This would hardly be worthy of special mention were we considering the pottery of old Mexico or of some other parts of the United States, but like the effigy vase above mentioned, from the caves of the Nantacks, it is exceptional in the pueblo region.

One of the best specimens of clay effigies was found in an ash heap at the Buena Vista ruin. It was evidently a handle of a dipper or saucer, and was well made and well proportioned.

The frequency with which these effigy ceramic objects occur as we go south is, as has been stated, highly suggestive. Unknown in the ancient ruins of northern Arizona, they are not rare in the Gila valley and its tributaries, and their number greatly increases when we pass the boundary line into the Mexican states of Sonora and Chihuahua. This is undoubtedly an advance in pottery manufacture, and, with this advance a corresponding decline in the decoration of vases with paintings is to be expected.

DISTRIBUTION OF DECORATED POTTERY IN ARIZONA

In plate LXX the author has tried to plot the distribution and relative abundance of different colored pottery in the ruins studied by him in the years 1895, 1896, and 1897. A normal line is represented on one side and the relative amount of each kind of colored pottery is indicated by abscissas from that norm, arising from a point representing the latitude of each ruin. In order to determine the proper percent of the kind of pottery in each ruin, the number of pieces obtained was counted, and the proportions of those referred to different colors were reduced to decimal fractions. In the case of red ware this was only an approximation, for the limit of this type was hard to determine.

Certain general laws may be deduced from a study of this map. Black and white ware, which is so prominent a feature of cliff-house pottery, has a limited distribution in all the ancient pueblos south of Tusayan proper. Its proportion increases in the Kintiel zone.

Yellow ware is the characteristic pottery of Tusayan and is limited to the ruins near the inhabited Hopi villages. It is not represented at Kintiel.

Red ware is characteristic of the Little Colorado. Red, white, and black ware is not found in the north or south, but only near the Little Colorado and its tributaries.

A brown pottery, with black decoration and red bands, is characteristic of the Gila valley ruins.

Study of the material collected in 1897 suggests the conclusion that the higher we ascend the Little Colorado river the greater are the differences between the archeological objects found on its banks and those of the ancient Hopis who lived at Homolobi. These differences seem not to diminish as we ascend the Zuñi river and other tributaries of the Little Colorado in the Zuñi reservation. At Four-mile ruin we find both Zuñi and Hopi characteristics in ancient pottery, and no doubt some of the people of this pueblo were akin to the ancient Zuñi stock.

There was probably not so close a likeness between the ancient people of Pueblo Viejo and those of modern Tusayan as between those of the Verde and Tonto villages and the Hopis, although there is a resemblance among all the ruins of the Gila valley and its tributaries. As a general rule, the culture of prehistoric peoples dwelling along the banks of a river has a marked uniformity, while that of those separated by mountain ranges is more varied. There is therefore a general likeness between the art products of the Gila valley and all its tributaries, and those of the Little Colorado are similar, but the archeology of the two drainage areas differs considerably.

EVOLUTION OF THE PUEBLO TYPE OF ARCHITECTURE

The Spanish word "pueblo" has come to be used in ethnology with a special meaning, and is now applied to a certain kind of Indian dwelling. While the Spanish explorers applied the term to any large cluster of houses it is well to limit it, as is now generally customary, to a communal village in compact form, with the different rooms adjoining. In this restricted meaning the clusters of houses in the Pueblo Viejo are not pueblos, but are better called composite rancherias.

A pueblo, then, may be regarded as a collection of rancherias the component houses of which have become so approximated that they adjoin, forming a compact village. Each clan has its own rooms and has no rights in others, though the walls may adjoin.

We have a very good illustration of a communal form of architecture in early Mormon settlements, as Brigham and Sunset, now in ruins near Homolobi. When these towns were built they were palisaded, and all the different families were protected by an inclosing wall. The houses joined, inclosing a central open space, much as in a small pueblo. Had there been no danger from Apaches or other predatory Indians, these Mormon families would probably have settled on separate farms, but it must also be borne in mind that there was community of life among the inhabitants which does not exist in Pueblo settlements. Each clan in the latter is independent; all families in the Mormon towns mentioned had common property. This

community of life no doubt explains in part the pueblo-like character of the Mormon settlements, but mutual defense was an important factor in the determination of the form of their villages.

The pueblo, therefore, as we find it today, is a survival of consolidated cliff houses, cavate villages, or rectangular and circular towns of the plain, which have assumed their form for the sake of defense. But these forms are secondary; in localities and at times when defense was not necessary the aboriginal farmers erected more or less isolated dwellings or ranches, each with few rooms and with accommodations for one clan.

In very ancient times the inhabitants of the Gila were scattered over the land, or their homes were clustered together, but were not united in a compact form with adjoining walls. Even then, however, they had certain common houses for defense or religious purposes, of which Casa Grande is a good example.

As the clans moved into exposed regions in which they were raided by hostiles they naturally built their houses in pueblos or forms best calculated for defense.

It is interesting to note that when this pressure of necessity for defense was removed the former distribution of small farmhouses over the land returned. When the clan was no longer forced to huddle under the same roof with its neighbor, it returned to the isolated rancheria. In this way large pueblos have disintegrated, first into summer farming villages, later into individual farmhouses. Thus, a law of the struggle for existence and survival of the fittest can be deduced to account for pueblo architecture in the Southwest. There is nothing in an arid environment to lead agriculturists to huddle into pueblos, and it was not until nomadic robbers forced them to do so that they adopted this form of life.

The semi-deserts of the Southwest are not valuable lands for agriculture, and yet the aboriginal people of this region were preeminently farmers. This is explained by the fact that it was impossible for hunters to remain in that culture stage, for there was no game; it was alike impossible to be fishermen, because there were no fishes. The people were forced by pressure of climatic conditions either to become farmers or to perish. In more fertile lands, where game was abundant, there roamed nomadic hunters with whom they were unable to successfully contend. Thus in an arid desert land the individual farmer became secure in his poverty from his warlike fellow-man. When, by his industry, he gathered property beyond his immediate needs, the nomads sought him out to despoil him of his possessions. To meet these attacks he joined his neighbors, building his houses in clusters, which, for additional protection, were finally consolidated into a pueblo form. As the enemies grew stronger the size of pueblos increased by consolidation. The form which the builders adopted was that best fitted for mutual protection. It has always been so

with agricultural man when pressed by his foes, and on this account a cliff-building stage of culture is limited to no race or country. Its existence is purely a geological question.

The Southwest is thus full of ruins of former abodes of farmers, some of which were inhabited by a single clan, others by several clans. Each has had its own history or its own episode in the general history of the struggle of nomadic robber and sedentary agriculturist. Aimlessly to himself, perhaps, but in obedience to a law of development, man has drifted from place to place to escape his enemies, until he has been molded into the peculiar culture which we call Pueblo. This culture is a highly specialized form, and is the direct outgrowth of the peculiar climatic conditions of the Southwest.



OLD CAVES, NEAR FLAGSTAFF, ARIZONA



NEW CAVES, NEAR FLAGSTAFF, ARIZONA



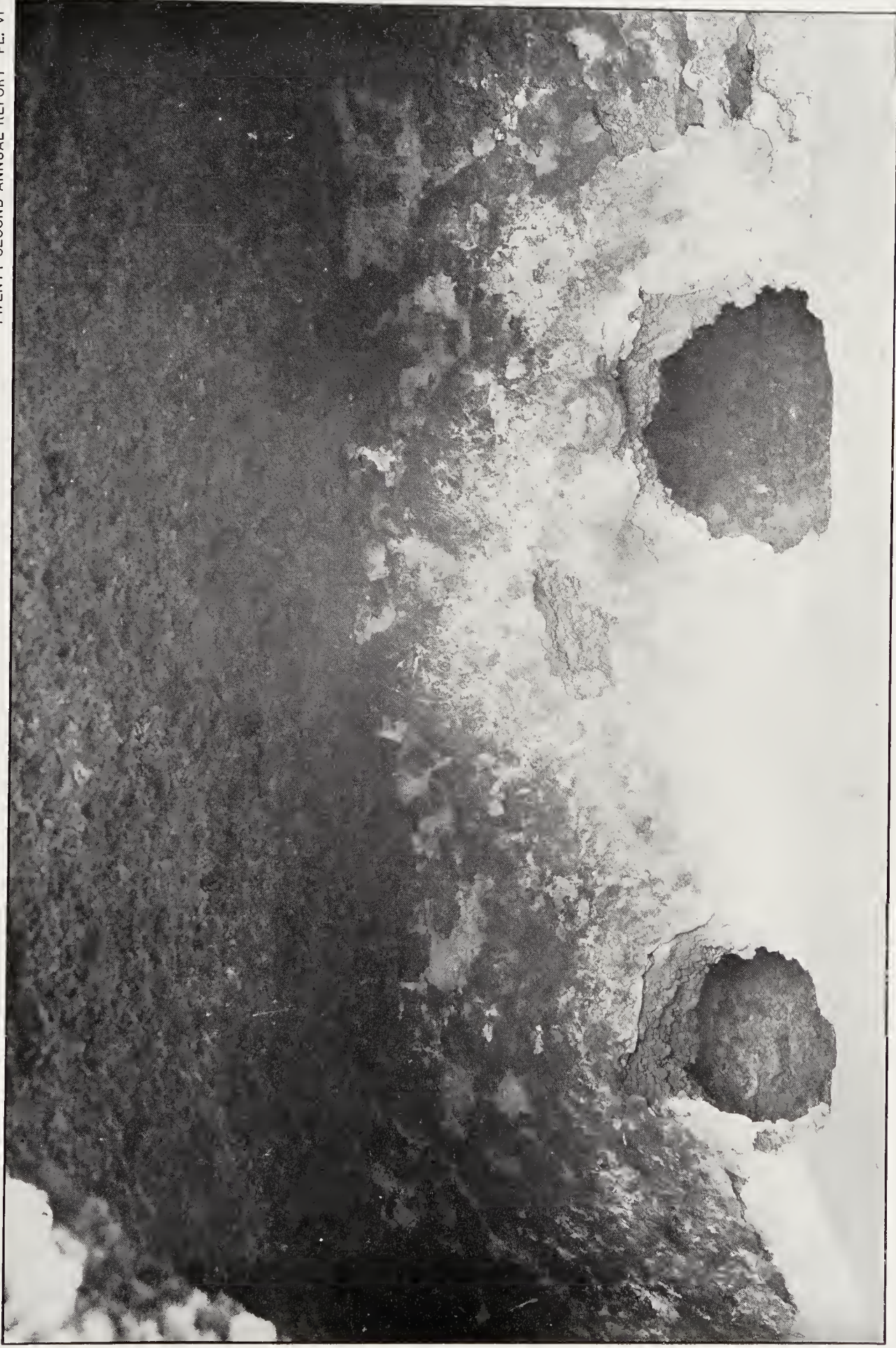
ENTRANCE TO NEW CAVE, NEAR FLAGSTAFF, ARIZONA



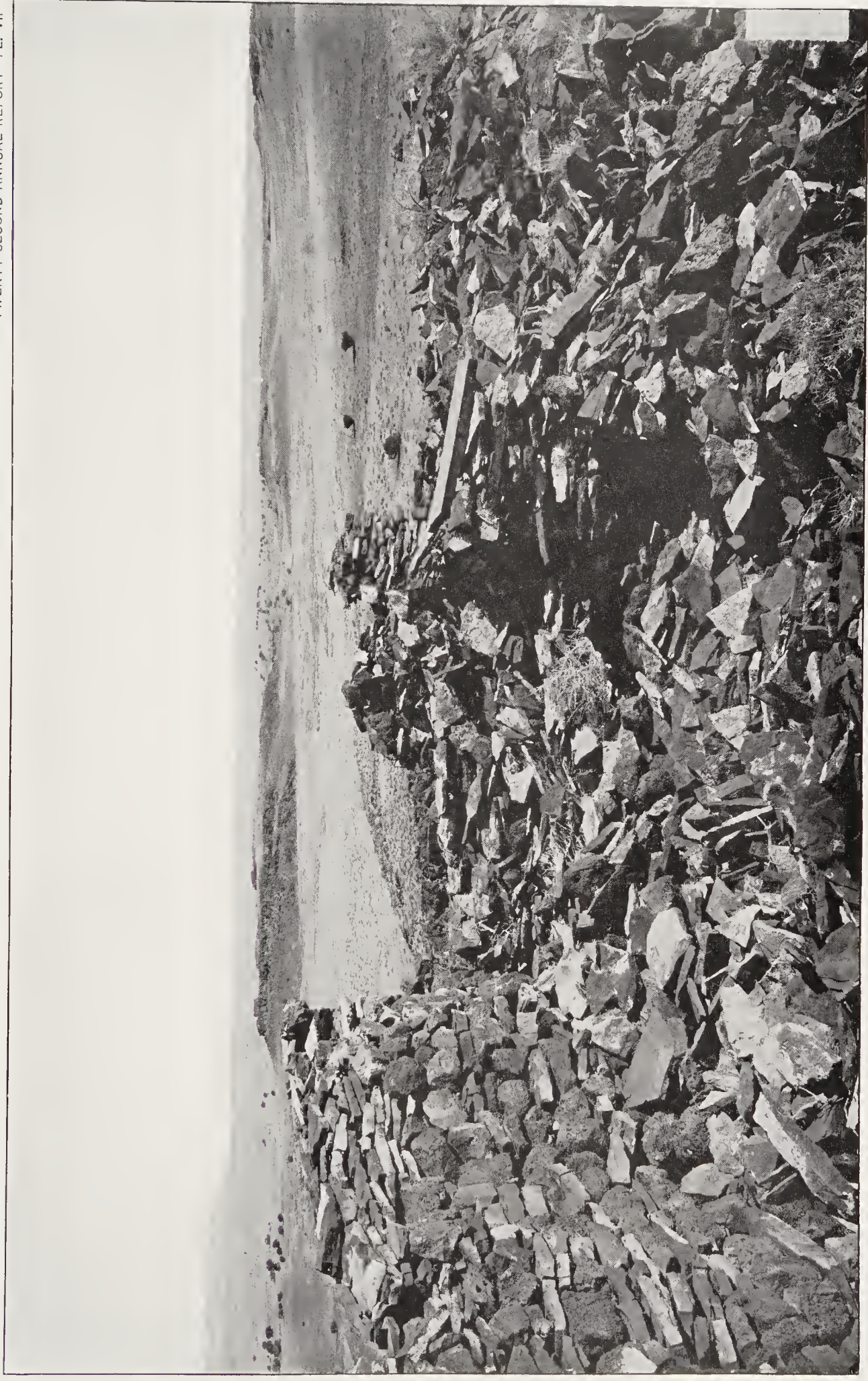
TURKEY TANKS CAVES, NEAR FLAGSTAFF, ARIZONA



INTERIOR OF CAVE NEAR FLAGSTAFF, ARIZONA



INTERIOR OF CAVE NEAR FLAGSTAFF, ARIZONA



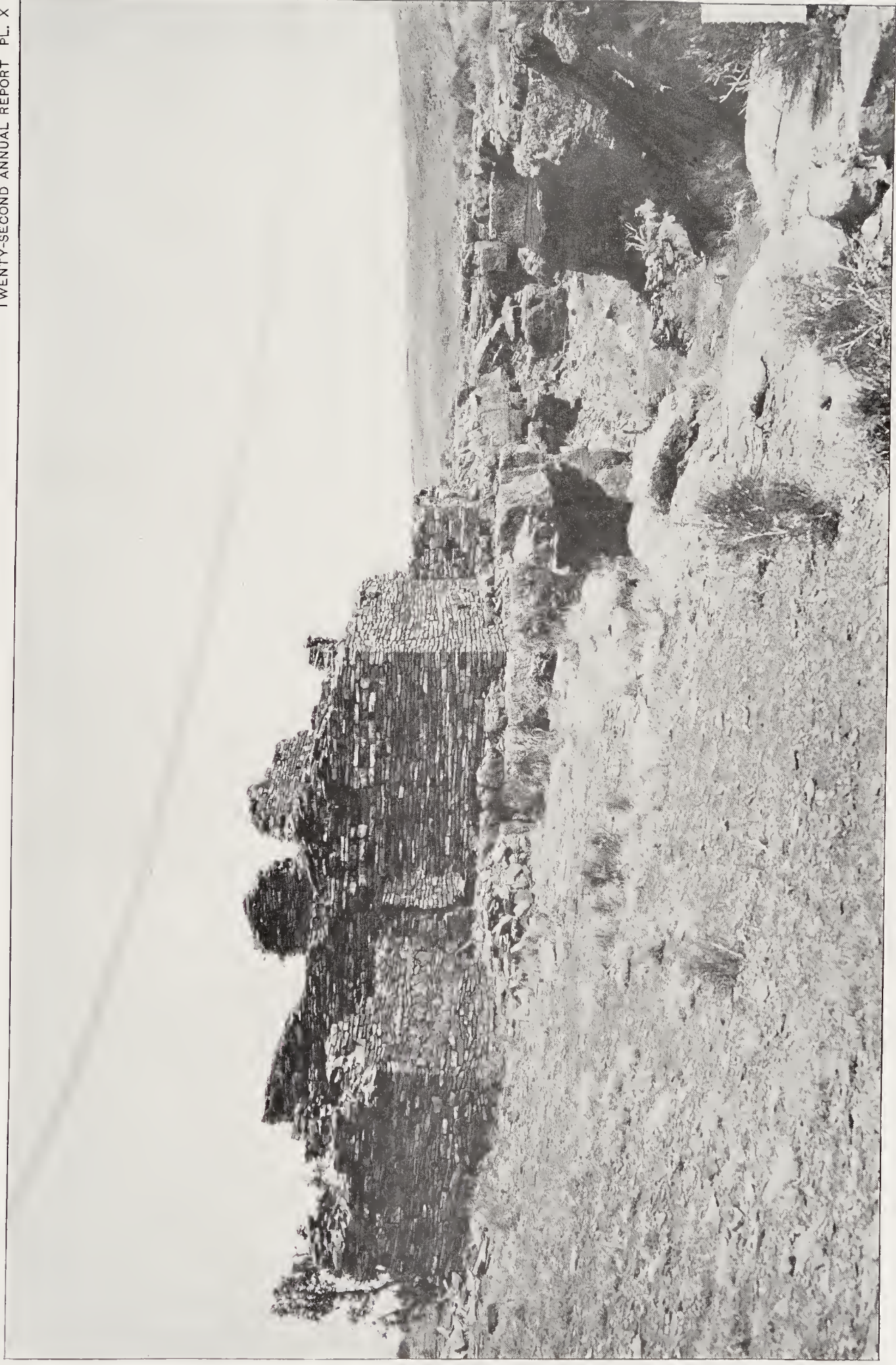
VIEW FROM THE CITADEL, GROUP A, BLACK FALLS, LITTLE COLORADO RIVER, ARIZONA



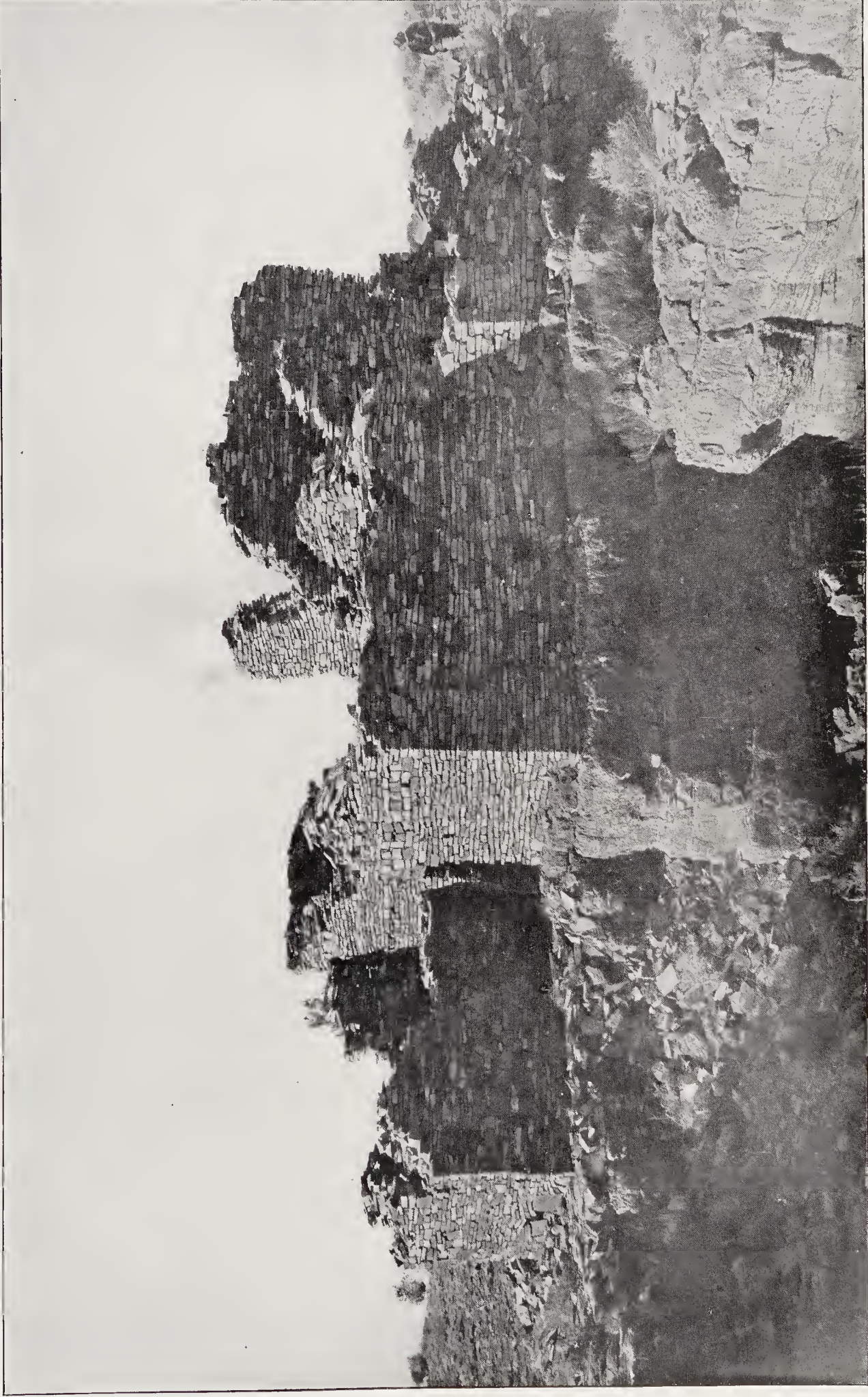
RUIN G, GROUP A, BLACK FALLS, LITTLE COLORADO RIVER, ARIZONA



RUINS H AND J, GROUP A, BLACK FALLS, LITTLE COLORADO RIVER, ARIZONA



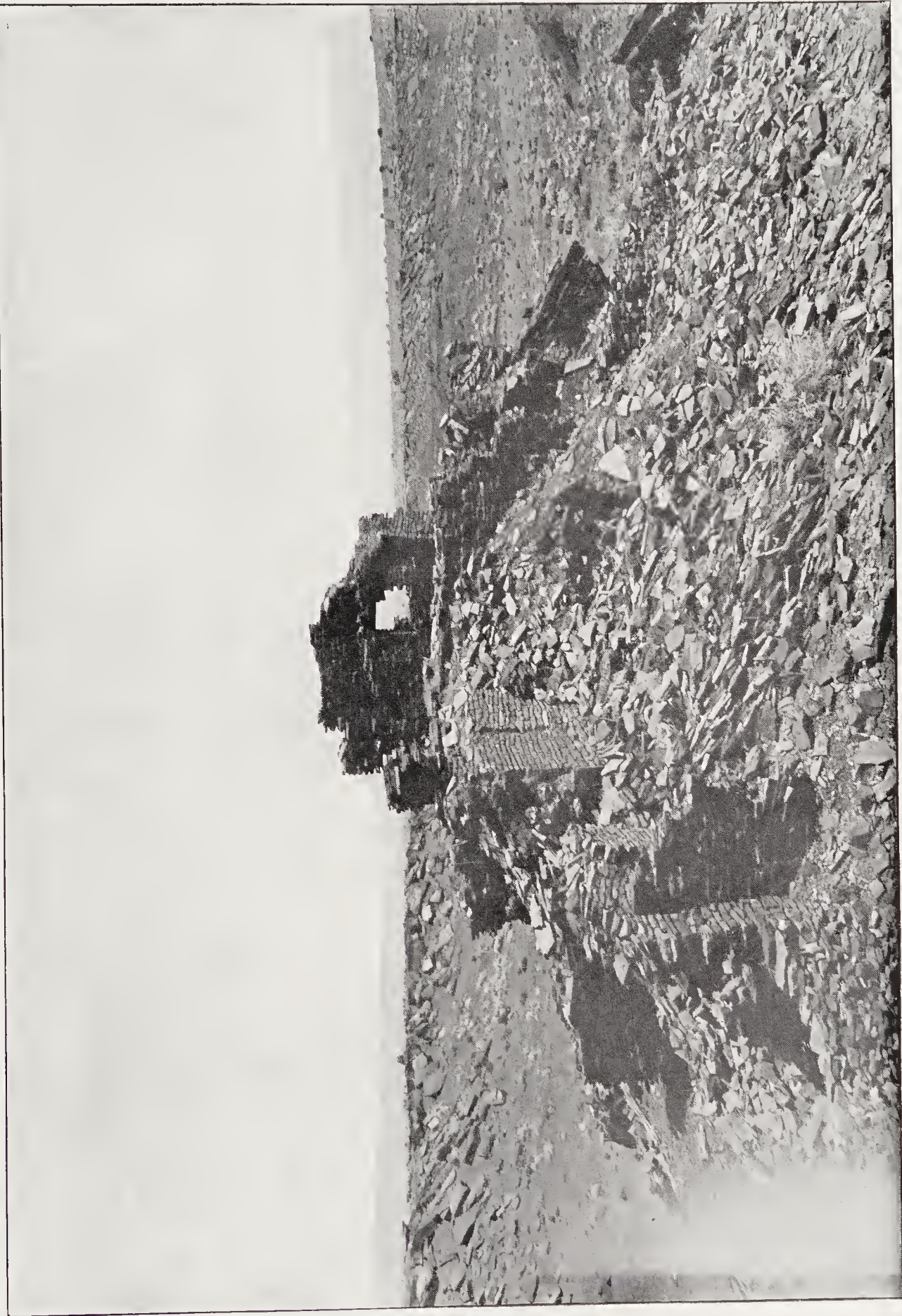
RUIN J, GROUP A, BLACK FALLS, LITTLE COLORADO RIVER, ARIZONA



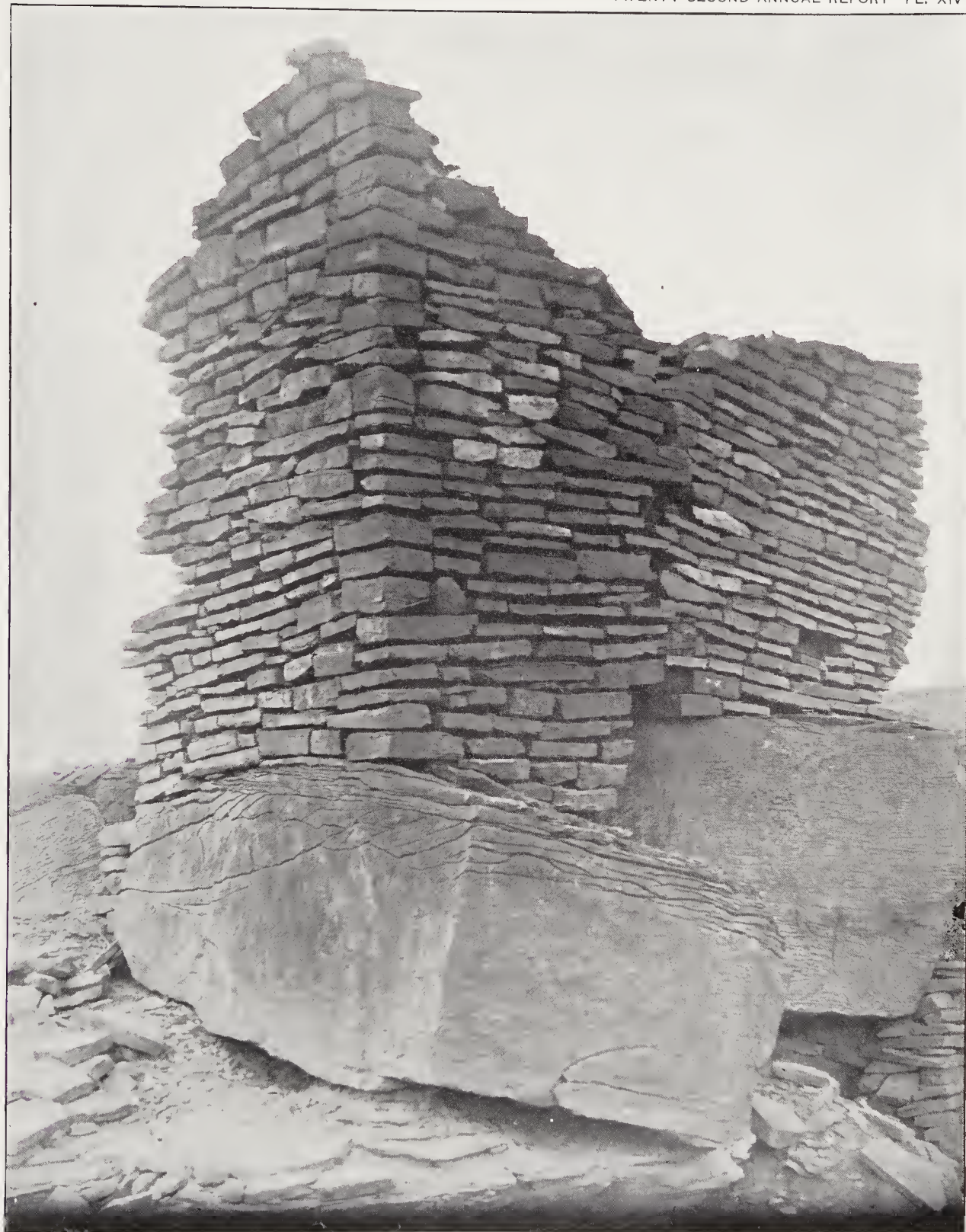
RUIN J, GROUP A, BLACK FALLS, LITTLE COLORADO RIVER ARIZONA



RUIN A, GROUP B, BLACK FALLS, LITTLE COLORADO RIVER, ARIZONA



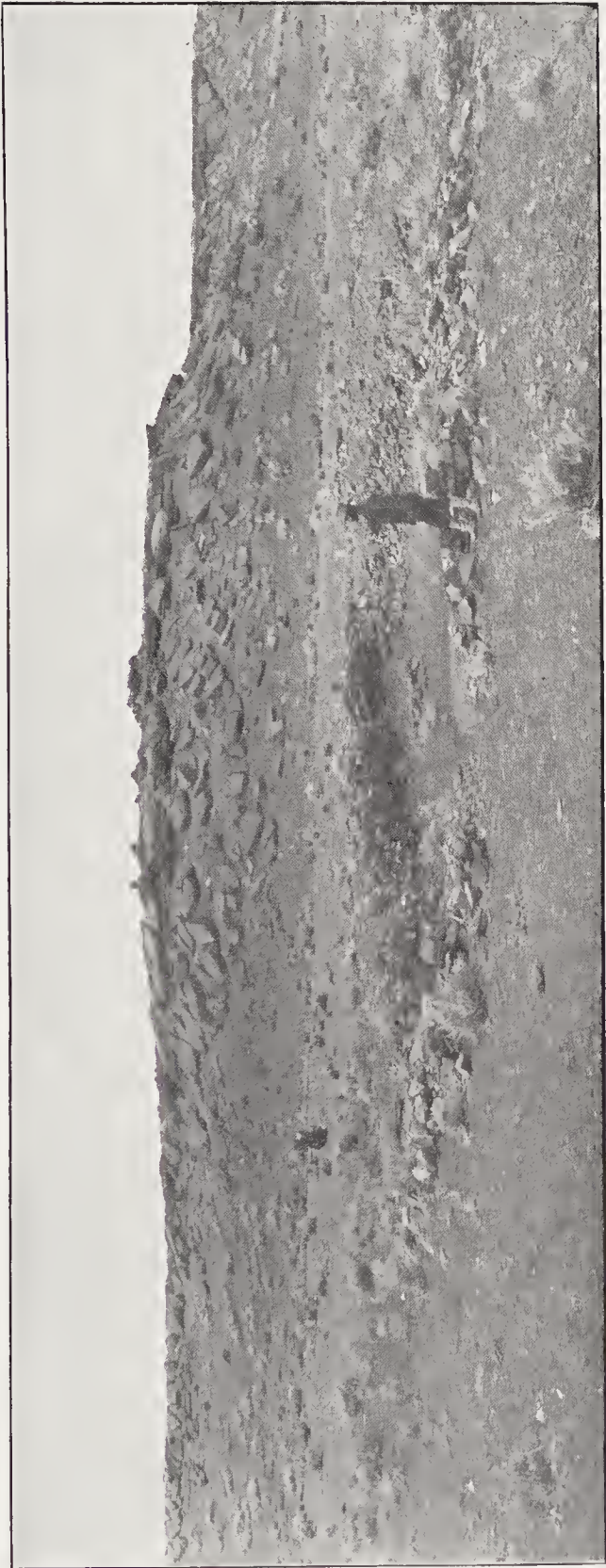
SECTION B, RUIN A, GROUP B, BLACK FALLS, LITTLE COLORADO RIVER, ARIZONA



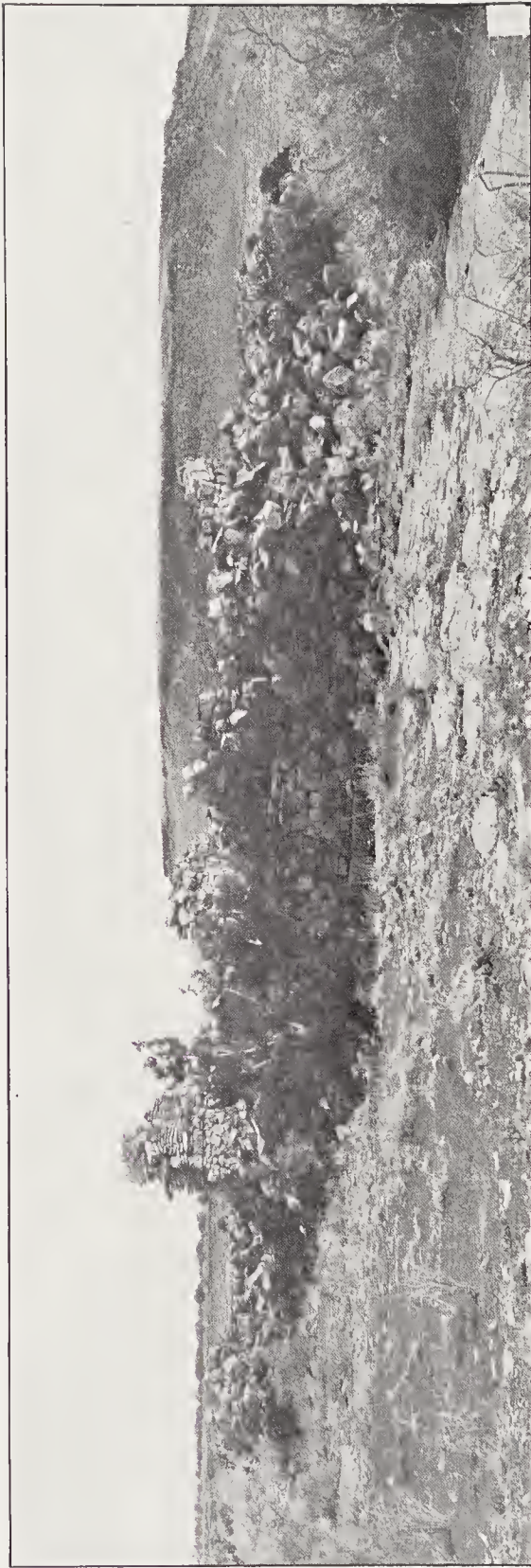
RUIN A, GROUP B, BLACK FALLS, LITTLE COLORADO RIVER, ARIZONA



CHIMNEY IN RUIN A, GROUP B, BLACK FALLS, LITTLE COLORADO RIVER, ARIZONA



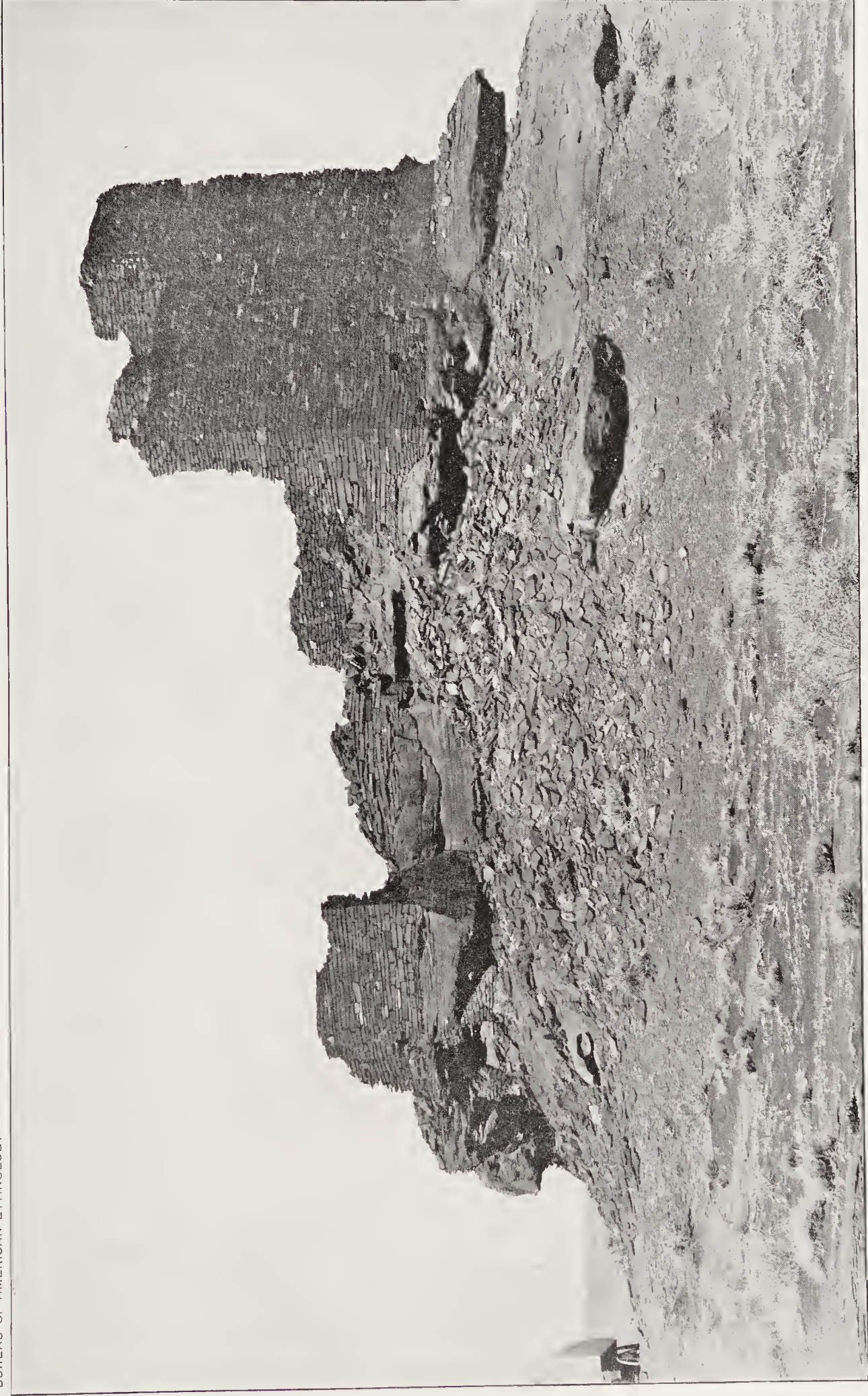
a RESERVOIR, RUIN A, GROUP B, BLACK FALLS, LITTLE COLORADO RIVER, ARIZONA



b SMALL RUIN NEAR CAMP, BLACK FALLS, LITTLE COLORADO RIVER, ARIZONA



RUIN A, GROUP C, BLACK FALLS, LITTLE COLORADO RIVER, ARIZONA
(VIEW FROM THE EAST)



RUIN A, GROUP C, BLACK FALLS, LITTLE COLORADO RIVER, ARIZONA
(VIEW FROM THE WEST)



RUIN A, GROUP C, BLACK FALLS, LITTLE COLORADO RIVER, ARIZONA
(VIEW FROM THE NORTH)



VASE FROM CHEVLON RUIN, ARIZONA
(NUMBER 157 005, DIAMETER 8 INCHES)



VASE FROM HOMOLOBI, ARIZONA
(NUMBER 157 016, DIAMETER 11 INCHES)



a (NUMBER 157 558, HEIGHT 6½ INCHES)



b (NUMBER 157 142, HEIGHT 7½ INCHES)

VASES FROM HOMOLOBI, ARIZONA



a (NUMBER 157 361, DIAMETER 9³/₈ INCHES)



b (NUMBER 157002 DIAMETER 10¹/₄ INCHES)

FOOD BOWLS FROM HOMOLOBI, ARIZONA



FOOD BOWL FROM FOUR-MILE RUIN, ARIZONA

(NUMBER 177864, DIAMETER 10¼ INCHES)



a (NUMBER 177293, DIAMETER 7 $\frac{3}{4}$ INCHES)



b (NUMBER 177110, DIAMETER 12 INCHES)



FOOD BOWL FROM FOUR-MILE RUIN, ARIZONA
(NUMBER 177 203, DIAMETER 10 INCHES)



a (NUMBER 156966, DIAMETER 8 $\frac{3}{4}$ INCHES)



b (NUMBER 156964, DIAMETER 8 INCHES)

FOOD BOWLS FROM HOMOLOBI, ARIZONA



b (NUMBER 157353, DIAMETER 8¾ INCHES)



a (NUMBER 157579, DIAMETER 3½ INCHES)



b (NUMBER 156 675, DIAMETER 10 INCHES)



a (NUMBER 157 523, DIAMETER 8 INCHES)



a



b

VASES FROM HOMOLOBI, ARIZONA



a



b

VASES FROM HOMOLOBI, ARIZONA



a (NUMBER 156666, DIAMETER 6½ INCHES)



b (NUMBER 156621, DIAMETER 6½ INCHES)

VASES FROM HOMOLOBI, ARIZONA



a (NUMBER 157374, HEIGHT 5 INCHES)



b (NUMBER 156489, HEIGHT 4½ INCHES)

VASES FROM HOMOLOBI, ARIZONA



a (NUMBER 157123, DIAMETER 3 INCHES)



b (NUMBER 157510, DIAMETER 5 3/4 INCHES)



c (NUMBER 156806, DIAMETER 5 1/2 INCHES)



a (NUMBER 157406, DIAMETER 5¼ INCHES)



b (NUMBER 177170, DIAMETER 5½ INCHES)



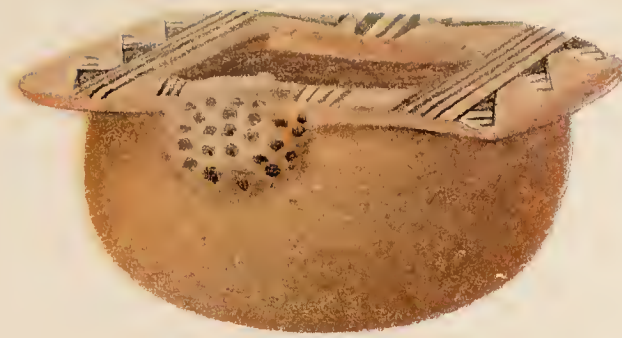
c (NUMBER 157143, DIAMETER 4½ INCHES)



d (NUMBER 156690, DIAMETER 3 INCHES)



e (NUMBER 177276, DIAMETER 4 INCHES)



a (NUMBER 157514, DIAMETER 5 INCHES)



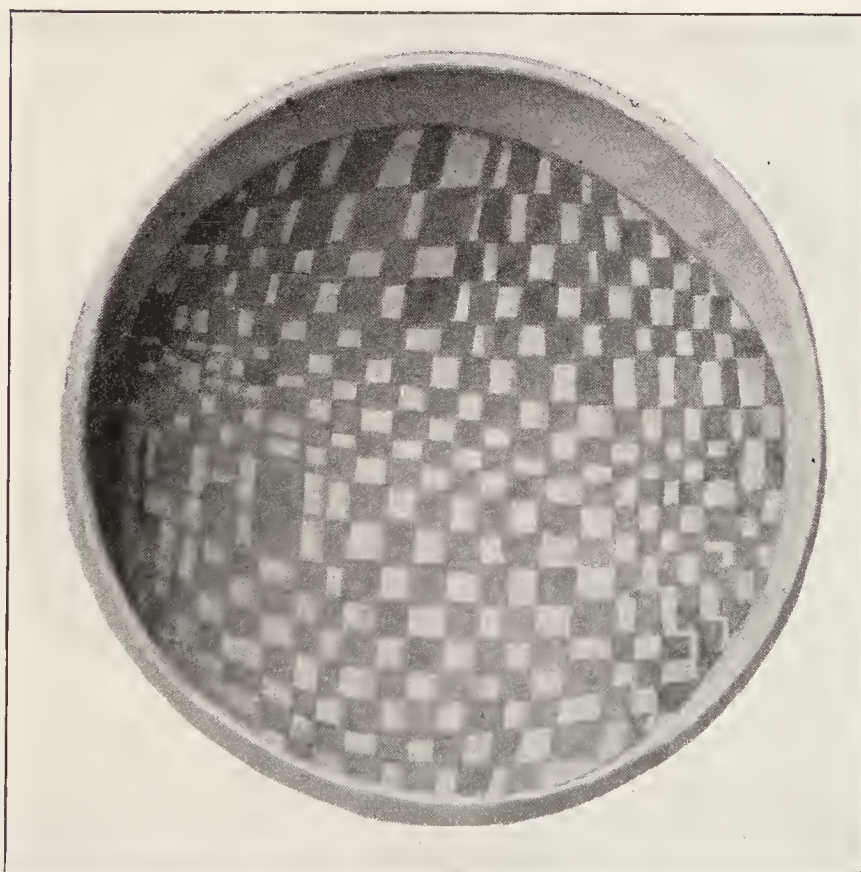
b (NUMBER 156517, DIAMETER 5½ INCHES)



c (NUMBER 156538, DIAMETER 5¾ INCHES)



a



b

FOOD BOWLS FROM CHEVLON, ARIZONA



a (NUMBER 157119, DIAMETER $5\frac{3}{4}$ INCHES)



b (NUMBER 157184, DIAMETER $5\frac{1}{2}$ INCHES)



a (NUMBER 157240, DIAMETER 7¾ INCHES)



b (NUMBER 157372, DIAMETER 8 INCHES)

FOOD BOWLS FROM CHEVLON, ARIZONA



a (NUMBER 177219, DIAMETER 9½ INCHES)



b (NUMBER 177086, DIAMETER 10½ INCHES)



a (NUMBER 177 223, DIAMETER 9 1/4 INCHES)



b (NUMBER 177 147, DIAMETER 9 INCHES)



α (NUMBER 176 963, DIAMETER 9 INCHES)



δ (NUMBER 177 356, DIAMETER 10 $\frac{1}{4}$ INCHES)



a (NUMBER 157120, DIAMETER 9 INCHES)



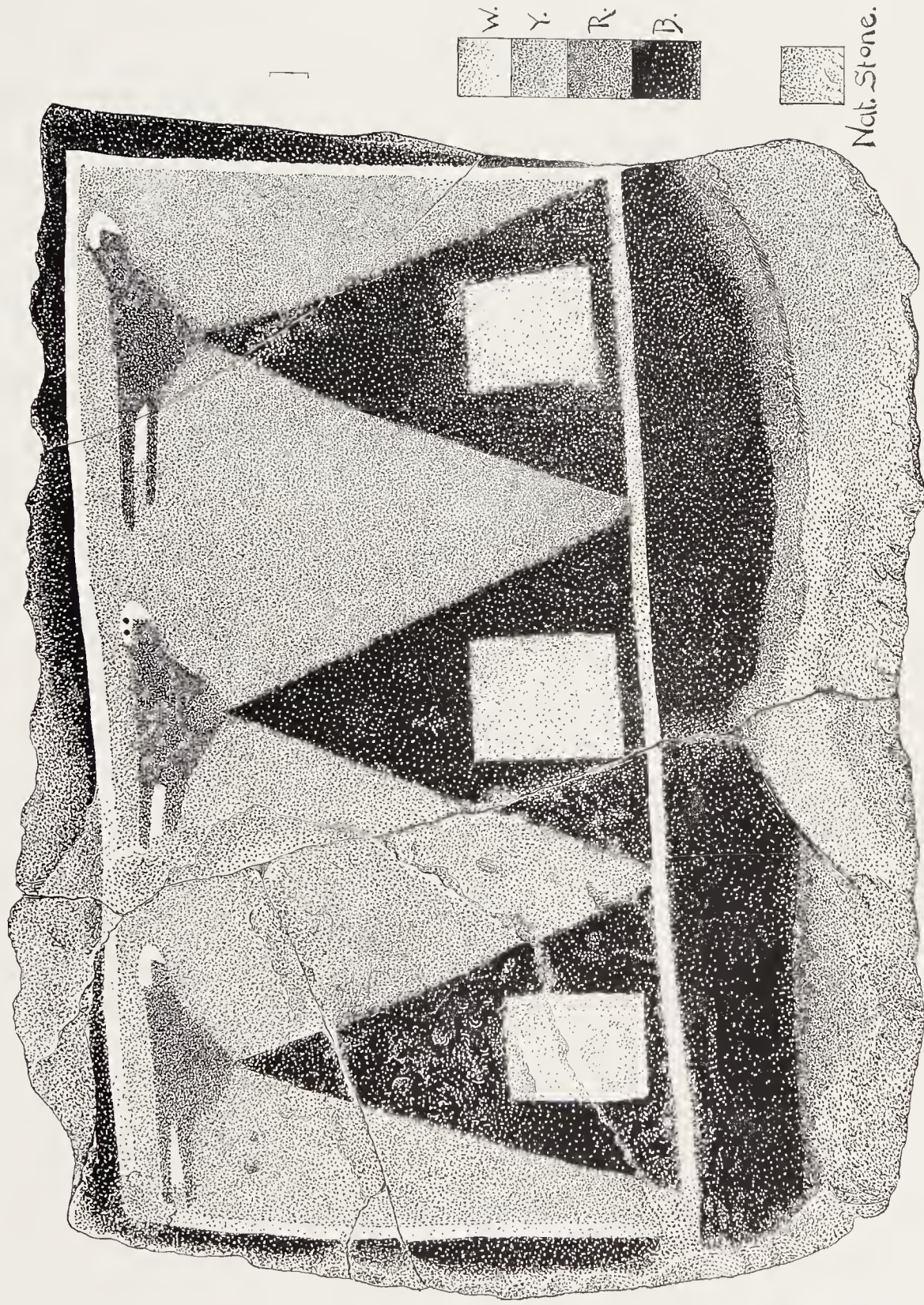
b (NUMBER 156494, DIAMETER 9 INCHES)



MOSAIC FROM CHAVES PASS, ARIZONA
(NUMBER 158071, ACTUAL SIZE)



BONE IMPLEMENTS FROM CHAVES PASS, ARIZONA



STONE SLAB WITH RAIN-CLOUD DESIGN, FROM CHEVLON, ARIZONA
(NUMBER 157293)



a (NUMBER 157142, DIAMETER 7½ INCHES)

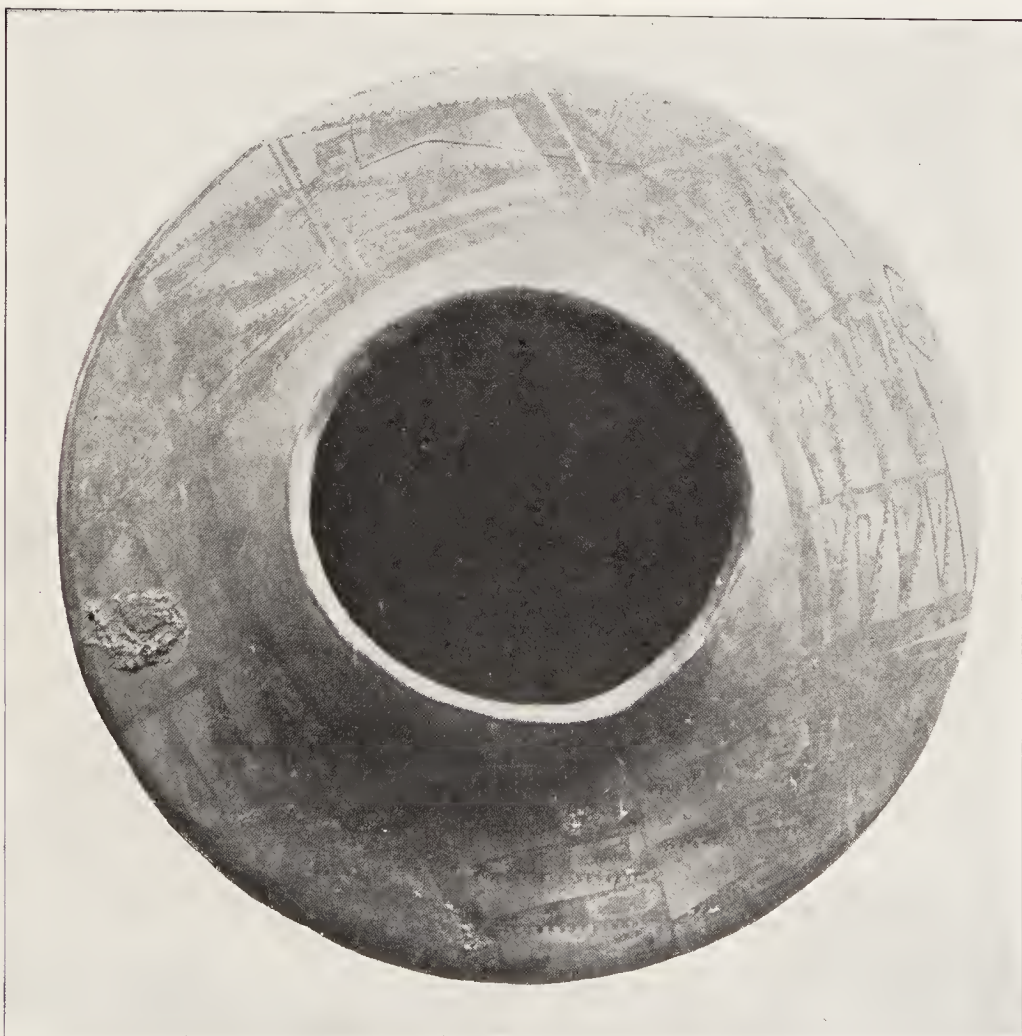


b (NUMBER 157276, DIAMETER 13¼ INCHES)

VASE AND FOOD BOWL FROM CHEVLON, ARIZONA



a



b

VASES FROM SHUMOPOVI, ARIZONA



VASE FROM SHUMOPOVI, ARIZONA



a



b

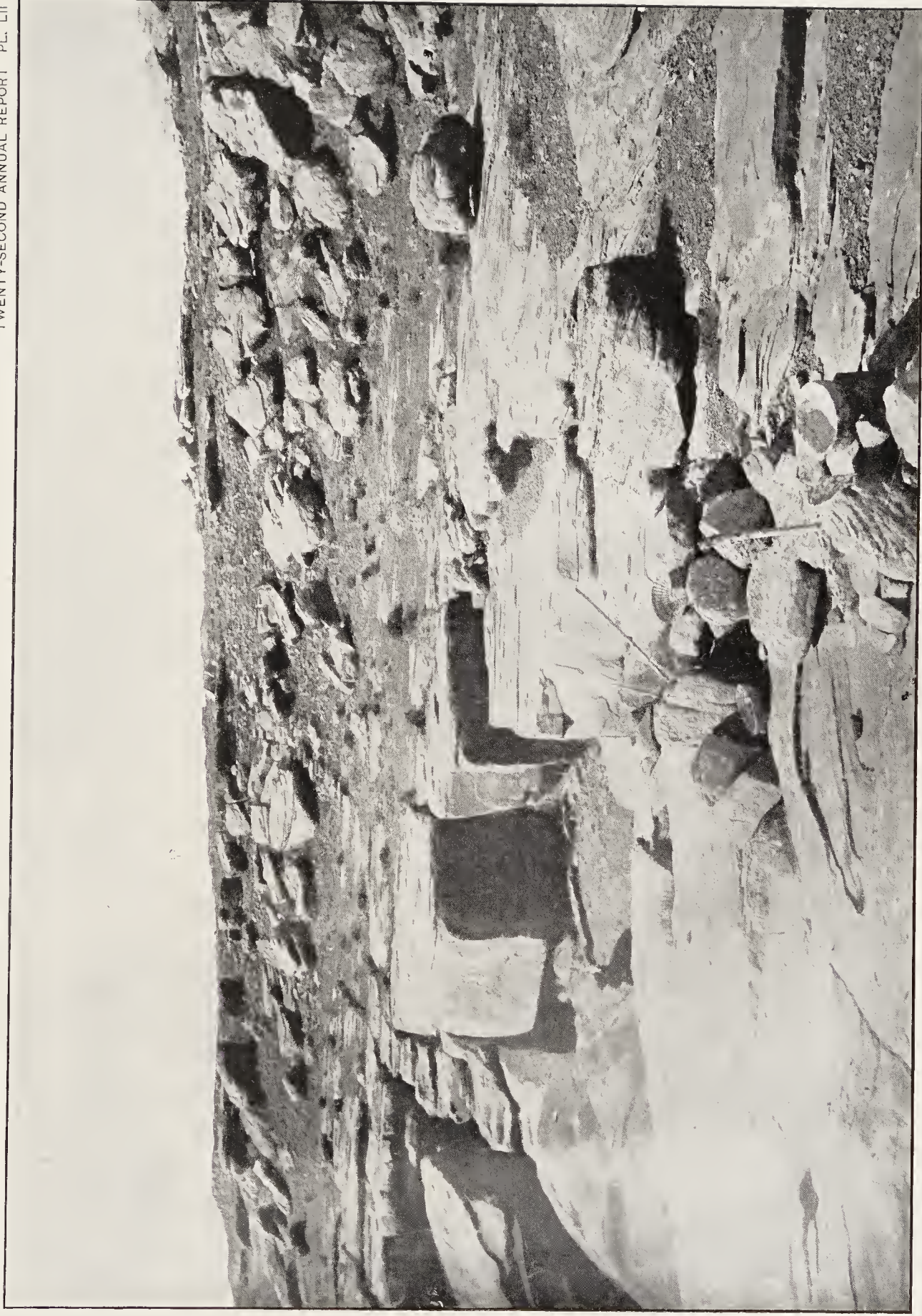
VASES FROM SHUMOPOVI, ARIZONA



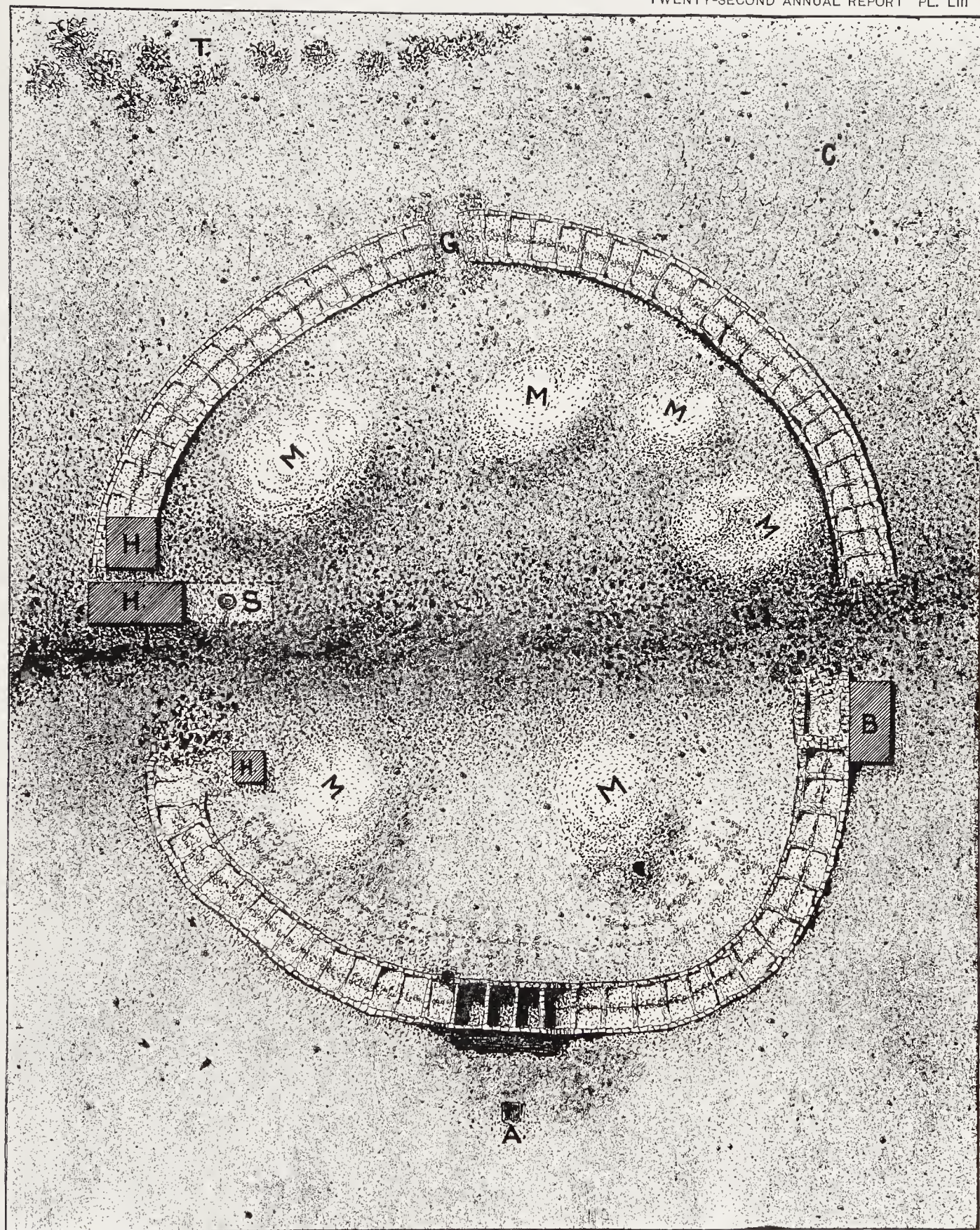
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b (NUMBER 157818, DIAMETER 9¾ INCHES)

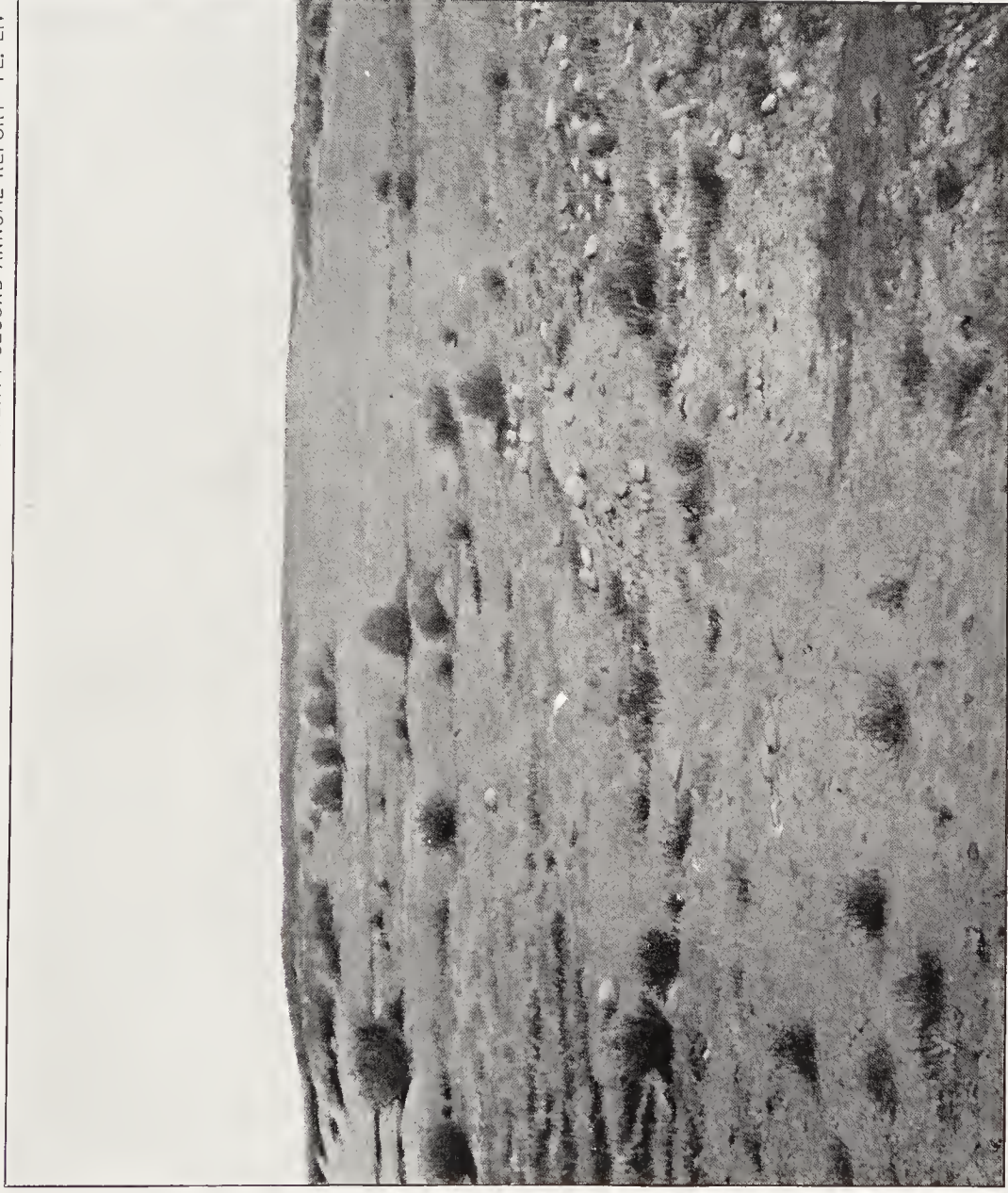


MODERN CEMETERY AT HOPI PUEBLOS, ARIZONA



PLAN OF KINTIEL RUIN, ARIZONA

A, altar; B, barn; C, cemetery; G, gateway; H, modern houses; M, mounds; S, spring; T, trees.



SURFACE OF MOUNDS AT FOUR-MILE RUIN, ARIZONA, BEFORE EXCAVATION



a (NUMBER 177535, DIAMETER 9 INCHES)



b (NUMBER 177534, DIAMETER 9 INCHES)

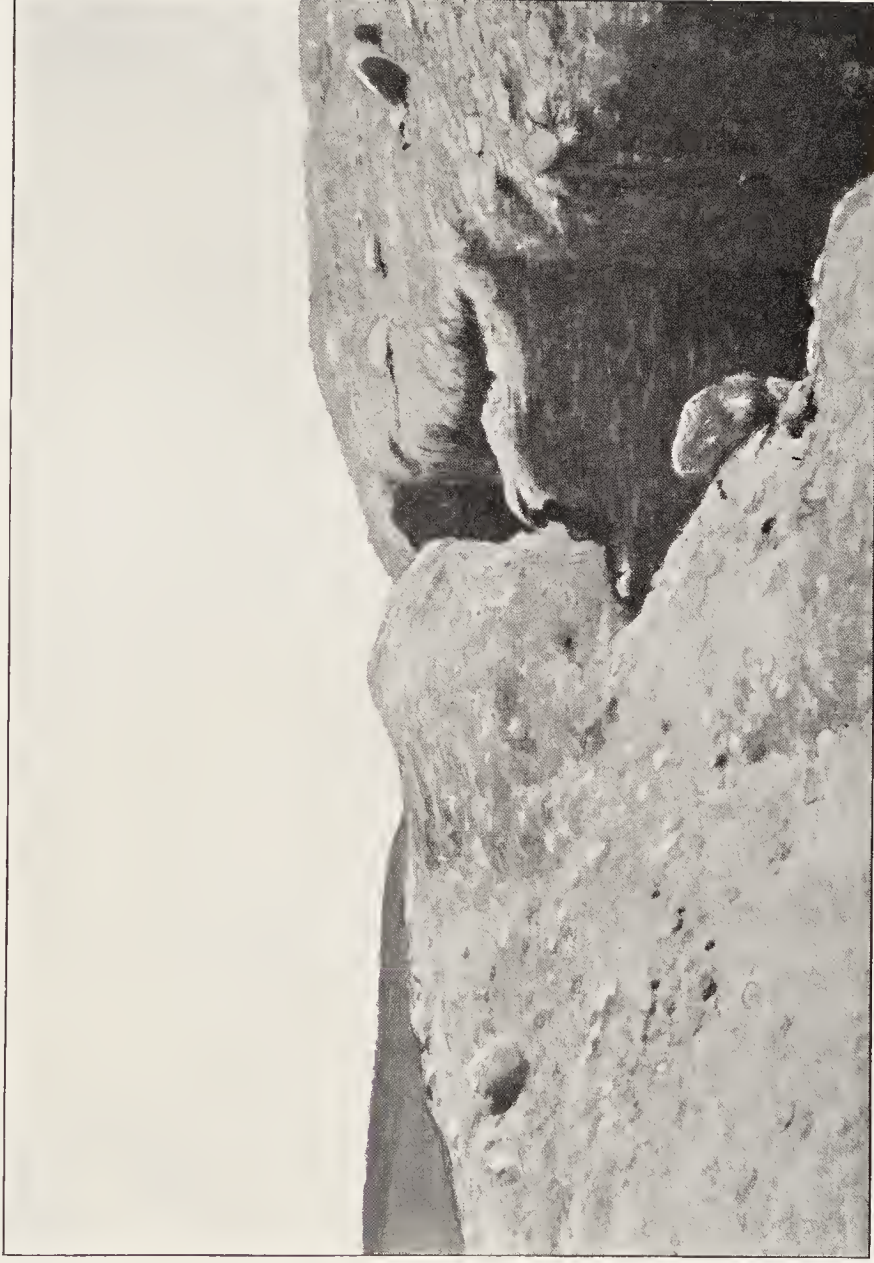


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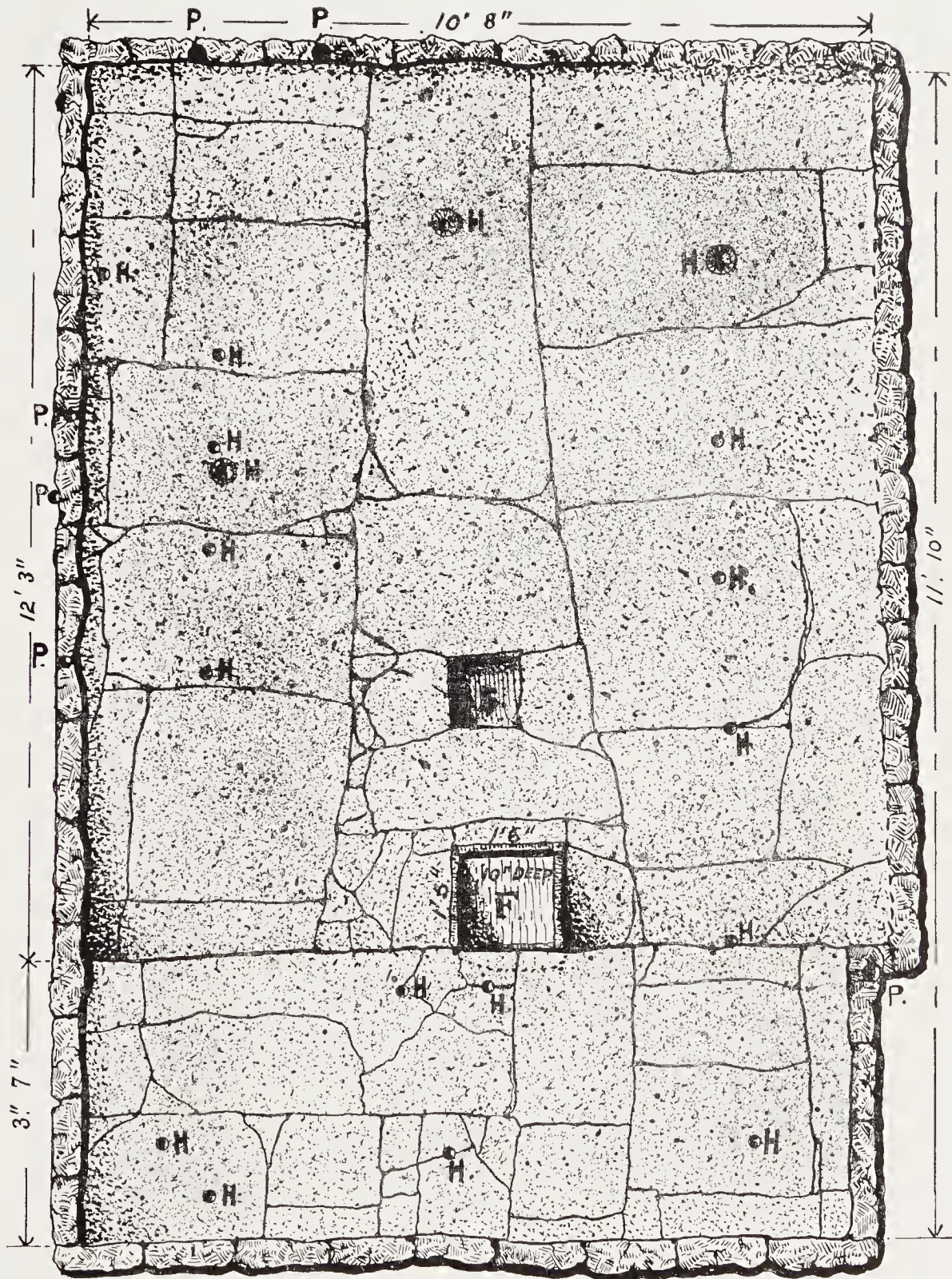


b (NUMBER 177231, DIAMETER 9 1/4 INCHES)

FOOD BOWLS FROM FOUR-MILE RUIN, ARIZONA



EXCAVATIONS AT FOUR-MILE RUIN, ARIZONA



PLAN OF A ROOM IN FOUR-MILE RUIN, ARIZONA
F, fireplace; H, holes; P, posts; S, shrine.



a (NUMBER 177234, DIAMETER 7½ INCHES)



b (NUMBER 177160, DIAMETER 7 INCHES)

VASE AND PITCHER FROM FOUR-MILE RUIN, ARIZONA



a (NUMBER 177048, DIAMETER 6 INCHES)



b (NUMBER 177099, DIAMETER 8 INCHES)

VASE AND FOOD BOWL FROM FOUR-MILE RUIN, ARIZONA



FOOD BOWLS FROM FOUR-MILE RUIN, ARIZONA



a



b

VASES FROM FOUR-MILE RUIN, ARIZONA



a (NUMBER 177 162, DIAMETER 5³/₄ INCHES)



b (NUMBER 177 147, DIAMETER 9³/₈ INCHES)



c (NUMBER 177 219, DIAMETER 9³/₈ INCHES)



d (NUMBER 177 327, DIAMETER 10⁵/₈ INCHES)



SPIRAL DESIGN ON FOOD BOWL FROM FOUR-MILE RUIN, ARIZONA



PERFORATED STONE SLAB AND LOOM STONES FROM FOUR-MILE RUIN, ARIZONA



PLAN OF BUENA VISTA RUIN, UPPER GILA VALLEY, ARIZONA

A, modern adobe buildings; C. H., central house; D, depression; E, excavations; M, mounds; R, reservoir; T, trees.



a (NUMBER 177 544, DIAMETER 6¾ INCHES)



b (NUMBER 177 566, DIAMETER 9½ INCHES)



c (NUMBER 157 154, DIAMETER 6½ INCHES)



VASE FROM PUEBLO VIEJO, UPPER GILA VALLEY, ARIZONA
(NUMBER 177521, DIAMETER 7 INCHES)



a (NUMBER 177536, DIAMETER 4½ INCHES)

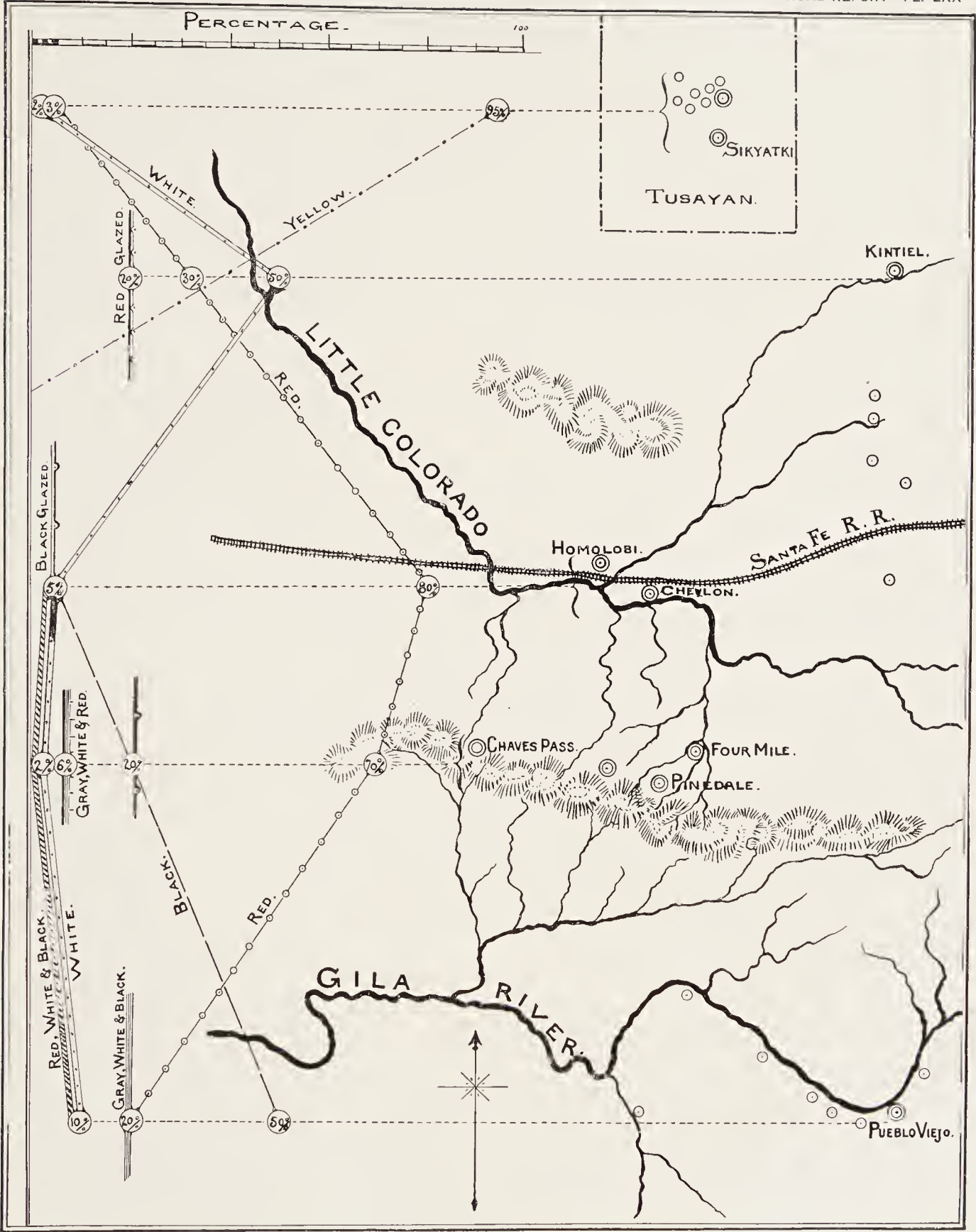


b (NUMBER 177520, DIAMETER 3½ INCHES)



c (NUMBER 177558, DIAMETER 9½ INCHES)

FOOD BOWLS AND VASES FROM PUEBLO VIEJO, UPPER GILA VALLEY, ARIZONA



MAP SHOWING DISTRIBUTION OF ANCIENT POTTERY IN ARIZONA

MAYAN CALENDAR SYSTEMS. II

BY

CYRUS THOMAS

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MAYAN CALENDAR SYSTEMS. II

By CYRUS THOMAS

PREFATORY NOTE

When the paper entitled *Mayan Calendar Systems*, published in the Nineteenth Annual Report of the Bureau of American Ethnology, was written, the parts of Maudslay's work^a relating to the ruins at Quirigua had not been received, and hence these important ruins could not then be considered, except so far as they were referred to by Goodman.^b As these parts of Maudslay's work are now at hand, it is my purpose to supplement my previous paper by some notes on the inscriptions at Quirigua, and to discuss points omitted or but lightly touched in it. One of the points but briefly noticed is the value of the different face numerals. As was stated, the determination of the value of these symbols necessitated a careful comparison of the series of the various inscriptions in which they are used, especially the initial series. This examination has been made, and the results are now given.

INITIAL SERIES OF MAYAN INSCRIPTIONS

The first inscription to which attention is called is that on the west side of Stela F. This is shown in the photograph (plate XXXIX) and the drawing (plate XL) in part 12 of Maudslay's *Archaeology*, volume 2, and in our plate LXXI. In regard to it Mr Goodman remarks as follows:

Initial date: 54-9-14-13-4×17-12 Caban-5 Kayab. The period numbers here are expressed by face numerals. Following this date are fifteen indeterminate glyphs. They do not include the usual initial directive series, but they probably serve the same or a similar purpose, for we can distinguish a number of period symbols with accompanying numerals, though unable to determine their meaning here. Then comes a reckoning which reads, reversing the order of periods for convenience, as I shall do in all cases when necessary: 13-9×9, from 12 Caban-5 Kayab, the initial date, to 6 Cimi-4 Tzec.

The first, or initial, time series, 54-9-14-13-4-17, 12 Caban 5 Kayab, is, as has been explained in my preceding paper, to be interpreted as

^a Maudslay, A. P. *Biologia Centrali-Americana: Archeology*. London, 1889-1902.

^b Goodman, J. T. *Archaic Maya inscriptions* (appendix to the preceding). London, 1897.

follows: Fifty-fourth great cycle, 9 cycles, 14 katuns, 13 ahaus, 4 chuens, and 17 days, to 12 Caban 5 Kayab, counting forward from 4 Ahau 8 Cumhu, the first day of the fifty-fourth great cycle, as Goodman has numbered these supposed time periods.

It is proper, however, to mention at the outset that the terms "great cycle," "cycle," "katun," "ahau," and "chuen" are used merely for convenience in comparisons with Goodman's renderings, and that I do not accept them as appropriate, or in any way adopt his theory that they denote real time periods, because I believe them to be nothing more than the orders of units in Mayan numeration; nor must it be understood that I accept his theory of a separate Mayan chronologic system. As the application of these terms has been fully explained in my previous paper, it is only necessary to restate here their numerical value:

1 chuen	20 days (1×20)
1 ahau	360 days (18×20)
1 katun	7,200 days ($18 \times 20 \times 20$)
1 cycle	144,000 days ($18 \times 20 \times 20 \times 20$)

The great cycle as given by Goodman equals 1,872,000 days or $18 \times 20 \times 20 \times 20 \times 13$, but should, as I shall endeavor to show, be counted as equal to 2,888,000 days, or $18 \times 20 \times 20 \times 20 \times 20$. The number 54 standing in the great-cycle place in the above series (54-9-14-13-4-17) is to be considered as having no numerical value; it is not to be read "54 great cycles," but "the fifty-fourth great cycle" (according to Goodman's method of numbering these supposed time periods), while the other numerals, 9, 14, etc., are to be used as true numbers—that is, 9 cycles, 14 katuns, 13 ahaus, 4 chuens, 17 days—the 54 being entirely omitted from the calculation. The sum of the series will therefore be as follows, the day being the unit:

9 cycles (each 144,000)	1,296,000 days ($9 \times 20 \times 20 \times 20 \times 18$)
14 katuns (each 7,200)	100,800 days ($14 \times 20 \times 20 \times 18$)
13 ahaus (each 360)	4,680 days ($13 \times 20 \times 18$)
4 chuens (each 20)	80 days (4×20)
17 days	17 days
Sum of the series	1,401,577 days

After the initial series the next number-series (reversed), 13-9-9, or 13 ahaus, 9 chuens, and 9 days, is found in the compound glyph numbered 16 in Maudslay's drawing, the numbering of which has been retained in our plate LXXI. The date which follows—6 Cimi 4 Tzec—is found in the right-hand portion of glyph 18 and the left-hand portion of glyph 19.

As all the numbers of the initial series, including that attached to the month and day forming the terminal date, are face characters, and are considerably worn and dim, the question arises, How did Goodman ascertain their number value?

Although some of these characters are so dim and imperfect that



INSCRIPTION ON THE WEST SIDE OF STELA F, QUIRIGUA
MAUDSLAY, PART 12, PLATE XL

their details can not be traced with certainty, I will overlook this for the present and will try to get the data necessary to determine their value.

Let us suppose at first that the number value of no one of them has been ascertained. The first step will be to count back from the date following the next numeral series, in which the numbers are of the ordinary type. Although the symbol interpreted Tzee is too much worn to be determined from the photograph, I accept the drawing, which seems to indicate this month, as the artist had an opportunity of inspecting the east. The date will therefore be 6 Cimi 4 Tzee. The preceding number series is 13-9-9, or 13 ahaus, 9 chuens, 9 days, and equals 4,869 days. By counting back from 6 Cimi 4 Tzee (year 1 Akbal) we reach 12 Caban 5 Kayab (year 13 Ben), the concluding date of the initial series as given by Goodman. This, if the month symbol of the second date has been correctly interpreted Tzee, gives us the value of the number symbols attached to the first date, 12 Caban 5 Kayab (glyphs 6 and 7, plate LXXI). Although these glyphs, as seen in the photograph, are scarcely distinct enough to be used in comparison, they are more clearly shown in the drawing, and present some characteristics which will assist us, especially that one (glyph 7) denoting 5, attached to the month symbol, where the superfix is a form of the ordinary ahau symbol. As neither of these is repeated in the initial series, they afford us no aid in determining other face numerals of the series.

It may be well, before proceeding farther with our examination of the series, to ascertain what data are necessary to determine the numbers of the time periods in an initial series, and this can best be done by examples. Here we have, supposedly, as the initial date, 4 Ahau 8 Cumhu (year 8 Ben), the first day of Goodman's fifty-fourth great cycle; and 12 Caban 5 Kayab is the concluding date of the series. That these two items are not sufficient to determine the intermediate time periods will be admitted without question.

Let us suppose, as a means of further test, that the numbers of chuens and days, "4 chuens 17 days," given by Goodman, are correct. That 9 eyeles, 14 katuns, 13 ahaus, 4 chuens, and 17 days, when counted forward from 4 Ahau 8 Cumhu, will bring us to 12 Caban 5 Kayab, as is maintained by Goodman, is true, as may easily be seen by making the calculation.

	Days
9 cycles	1,296,000
14 katuns	100,800
13 ahaus	4,680
4 chuens	80
17 days	17
Total	1,401,577
Subtract 73 calendar rounds	1,385,540
Remainder	16,037

Subtracting from this remainder the 17 days which remain in the year 8 Ben, after 4 Ahau 8 Cumhu, and dividing the remainder by 365, we obtain 43 years 16 months and 5 days. Counting forward this length of time (in the manner explained in my previous paper) from 4 Ahau 8 Cumhu, year 8 Ben, brings us to 12 Caban 5 Kayab, year 13 Ben.^a

The "calendar round" is, as has been explained in my previous paper, the term Goodman applies to the 52-year cycle, at the end of which period, counting from any point, the same date as that from which we count returns. The casting out of these calendar rounds, each of which amounts to 18,980 days, does not affect the result, as counting the remainder from the initial to the terminal date will give precisely the same result as counting the entire sum of the series—except that to determine the lapse of time, the number of years covered by the calendar rounds cast out must be added. For example, in case of the above-mentioned series, as 73 calendar rounds were cast out, 73×52 years must be added to the result obtained by dividing the remainder by 365, in order to ascertain the real lapse of time from the initial to the terminal date.

Having the date 12 Caban 5 Kayab and (supposed) the 4 chuens (or months) and 17 days, we turn to my condensed calendar or to Goodman's "Archaic Annual Calendar," and search through the tables of years until we find the year in which 12 Caban is the 5th day of the month Kayab. This in Goodman's tables is found to be the 51st year, or, in my table, the year 13 Ben. Counting back on the table of this year 4 months and 17 days, we reach 6 Ahau, the 8th day of the month Ceh, which, according to Goodman's scheme, will be the first day of an ahau. Turning now to Goodman's "Archaic Chronological Calendar" and to his 54th great cycle, we hunt for the place where 6 Ahau is the 8th day of the month Ceh. We find this in the 9th cycle, 14th katun, and looking at the column at the left margin we ascertain that it is the 13th ahau, which agrees exactly with the initial series as given above (54-9-14-13-4-17).

This seems to be confirmatory; however, before accepting it as conclusive let us examine a little further. Without any change, or supposed change, from the date and numbers of chuens and days used in the preceding calculation, we look farther in Goodman's "Archaic Chronological Calendar" to see if 6 Ahau 8 Ceh can be found elsewhere, confining our examination to his 54th great cycle. We do find it in the 13th cycle, 4th katun, 17th ahau, which gives the series 54-13-4-17-4-17.

Remembering that the 13th cycle, according to his scheme, is the first cycle of his great cycle, and must, therefore, be omitted from the calculation, and counting forward 4 katuns, 17 ahaus, 4 chuens, and 17 days from 4 Ahau 8 Cumhu, the first day of the great cycle, we

^a For condensed calendar and table of years see the end of this paper.

reach 12 Caban 5 Kayab, the required date, as with the preceding series. Looking farther we find 6 Ahau 8 Ceh in the 2d cycle, 12th katun, 6th ahau, giving the series 54-2-12-6-4-17, which also carries us to the proper date (12 Caban 5 Kayab). The date 6 Ahau 8 Ceh is also found in the 4th cycle, 19th katun, 15th ahau, and other places in the 54th great cycle, each of which gives the proper result. But this is not all, as we also find 6 Ahau 8 Ceh in the 53d great cycle in the 1st cycle, 7th katun, and 12th ahau, giving the series 53-1-7-12-4-17, which, counted from 4 Ahau 8 Zotz, the first day of the 53d great cycle, brings us to 12 Caban 5 Kayab, the required date. Other series which will give the proper result might be noted, but these will suffice to show that the initial and terminal dates and the chuens and days do not afford sufficient data by which to determine the series. It is necessary, therefore, to know the numbers attached to one or more of the other time periods of the series, and these must be ascertained in every instance by inspection and by a previously obtained knowledge of the value of one or more of the face numerals.

Referring again to the initial series under consideration—54-9-14-13-4-17, 12 Caban 5 Kayab—and holding to our assumption that the number of the chuens and days is correct, the date being satisfactorily determined, we proceed to learn what additional data are necessary to determine the series.

If inspection and a knowledge of the face numbers prove the one attached to the cycle in this instance to be 9, then the series as given above is the only one that will agree with the data, and we are thus enabled to determine the value of the face numerals attached to the katun and ahau symbols; and should that giving the number of days be imperfect or obliterated, it would still be possible to determine the series, as the date with the other items mentioned (number of chuens and cycles) is always sufficient to fix the other numbers in the series. If the number attached to the chuens be unknown, then the series could not be determined with the other data mentioned.

Suppose the number (9 in this case) attached to the cycle symbol to be imperfect or unknown, but that attached to the katun (14 in this instance) to be known, the series given above is the only one that will agree with the data. If the numbers attached to the cycle and katun be indeterminable, but that attached to the ahau symbol (13 in this instance) be known, the series can still be determined, and will be as given. It is apparent, therefore, that, with the initial and terminal dates and chuens and days known, the number attached to one of the other elements in the series is necessary in order to determine the series. It is also demonstrable that with these data the series can be at once determined by Goodman's tables, though this, as I shall show, does not prove that his theory of the Mayan time system or his method of numbering the cycles or great cycles is correct.

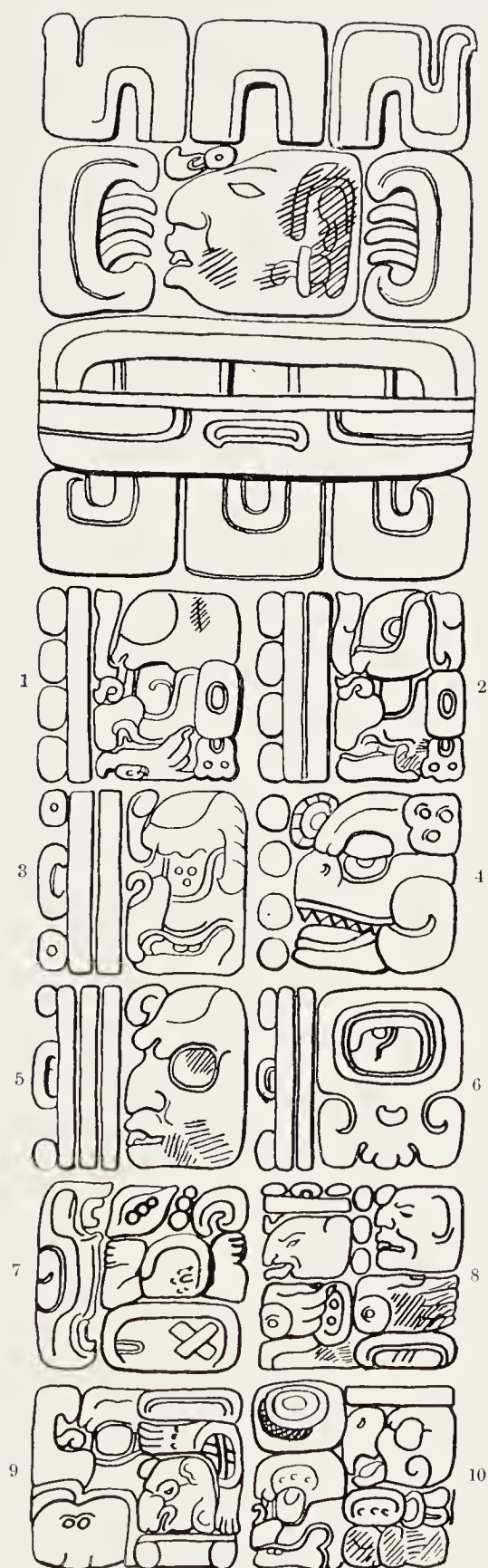
Continuing our investigation of the data necessary to determine the series, still referring to the one under consideration, we will next suppose that the number of chuens can not be determined by inspection.

The terminal date being given—12 Caban 5 Kayab (which falls in a Ben year)—it is readily seen, by reference to Goodman's "Archaic Annual Calendar," 51st year, or to my condensed calendar, that it requires 17 days, counting back, to reach an Ahau which falls on the 8th day of the month (Goodman begins the count with 20 Eb, but this gives Ben as the 1st day of the month, and the result is the same), hence the Ahau to be used depends on the number of chuens—if 0 chuens 17 days, it will be—as seen by the table referred to—8 Ahau 8 Pax; if 1 chuen 17 days, then 1 Ahau 8 Muan; if 2—17, then 7 Ahau 8 Kankin; if 3—17, then 13 Ahau 8 Mac; if 4—17, then 6 Ahau 8 Ceh; if 5—17, then 12 Ahau 8 Zac; if 6—17, then 5 Ahau 8 Yax; if 7—17, then 11 Ahau 8 Chen; if 8—17, then 4 Ahau 8 Mol; if 9—17, then 10 Ahau 8 Yaxkin; if 10—17, then 3 Ahau 8 Xul; if 11—17, then 9 Ahau 8 Tzee; if 12—17, then 2 Ahau 8 Zotz; if 13—17, then 8 Ahau 8 Zip; if 14—17, then 1 Ahau 8 Uo; if 15—17, then 7 Ahau 8 Pop; if 16—17, then 9 Ahau 8 Cumhu; if 17—17, then 2 Ahau 8 Kayab. The fact that Ahau is the 8th day of the month in each case greatly limits the range of possibilities.

Suppose that, in addition to the terminal date, the numbers of cycles and katuns are also known (9 and 14 in this instance); the series can be definitely determined, and will be as given above. If the numbers of cycles (9) and ahaus (13) are known and the number of katuns is unknown, the series "54-9-14-13-4-17" will give the correct date, but there is one other—53-9-13-13-13-17—which will also give the correct date, 12 Caban 5 Kayab. In this case the correct determination of the series depends on the initial day of the great cycle, to which attention will be called farther on.

We next take the case where, in addition to the dates and the number of days, the numbers of katuns and ahaus are known, and the number of cycles is unknown. In the series under consideration the number of katuns is 14, of ahaus 13. These data are sufficient to determine the series, and in this instance the result is as given above.

The next inquiry relates to the data necessary to determine the terminal date where this can not be recognized by inspection, or where that given is erroneous. Where neither the day nor the day of the month is known, it is necessary to have the entire numeral series—that is, 54-9-14-13-4-17, in the example we have been using—in order to determine the date. If the day of the terminal date of the series can be ascertained by inspection, then the date can be determined without knowing the number of days; thus 54-9-14-13-4-?, ? Caban ? (month) will be sufficient to ascertain that this terminal date is 12 Caban 5 Kayab. Turning to Goodman's "Archaic Chronological Calendar," 54th great cycle, 9th cycle, 14th katun, 13th ahau, we find



INSCRIPTION ON THE WEST SIDE OF STELA E, QUIRIGUA

MAUDSLAY, PART 12, PLATE XXXI

6 Ahau 8 Ceh. Searching through his "Archaic Annual Calendar" we find that 6 Ahau 8 Ceh occurs only in the 51st year, and that Caban is the 5th day of the month in this year. Counting forward 4 months from Ceh brings us to Kayab, where 12 Caban is the 5th day. We thus ascertain that 12 Caban 5 Kayab is the date sought.

If the number of days, the name of the day of the terminal date, the month, and day of the month be unknown—thus in our example 54-9-14-13-4-?, 12 (day) ? (month)—it is possible to limit the result to one of two days, in this case to 12 Kan 12 Pax, or 12 Caban 5 Kayab. In the first case, the number of days will be 4, and in the second 17. If the number of chuens and the day and month of the date be unknown, but the number of the day and the day of the month known, the date can be determined.

There are occasional side aids which may be taken advantage of in the investigation of the face numerals. One example which we will notice, bearing on the series which has been under consideration (initial series 54-9-14-13-4-17, west side Stela F, Quirigua), is as follows: The initial series on the west side of Stela E, Quirigua (plate LXXII), is, ordinary numerals being used throughout, and all distinct, 54-9-14-12-4-17, 12 Caban 5 Cayab. This is identical with the other series, except that there are only 12 ahaus, while in the other there are 13.

Although all that is positively known in regard to the first series (so far as our present investigation has extended) is the initial and terminal dates, the number of the days, and the day of the month on which the Ahau falls, we also know that the series as given above will agree with these items. If the 12 ahaus in the second series given above should, in fact, be 13, there will be perfect agreement with that on the west side of Stela F. It is evident from what has been shown above that, with all the items of the series save one being known, that item can be determined although wholly obliterated or incorrect. Enough is given to show that, counting back 4 months and 17 days from 12 Caban 5 Kayab, we reach 6 Ahau 8 Ceh. By calculation, or by referring to Goodman's "Archaic Chronological Calendar," 54th great cycle, 9th cycle, and 14th katun, it is seen that 6 Ahau 8 Ceh can only be in the 13th ahau, and is not found in the same cycle and katun in either the 53rd or 55th great cycle. The question as to whether Goodman's tables cover the range of the initial series will be considered farther on, when we have investigated more series. However, the fact that the series on the west side of Stela E, when the number of ahaus has thus been corrected (as calculation also shows 12 to be wrong), agrees precisely with the rendering given of that on the west side of Stela F is not proof that this rendering is correct, it only adds a degree of probability, supposing that Goodman has based his determination on an examination of the face characters. The fact may be noted, also, that some two or three other inscriptions

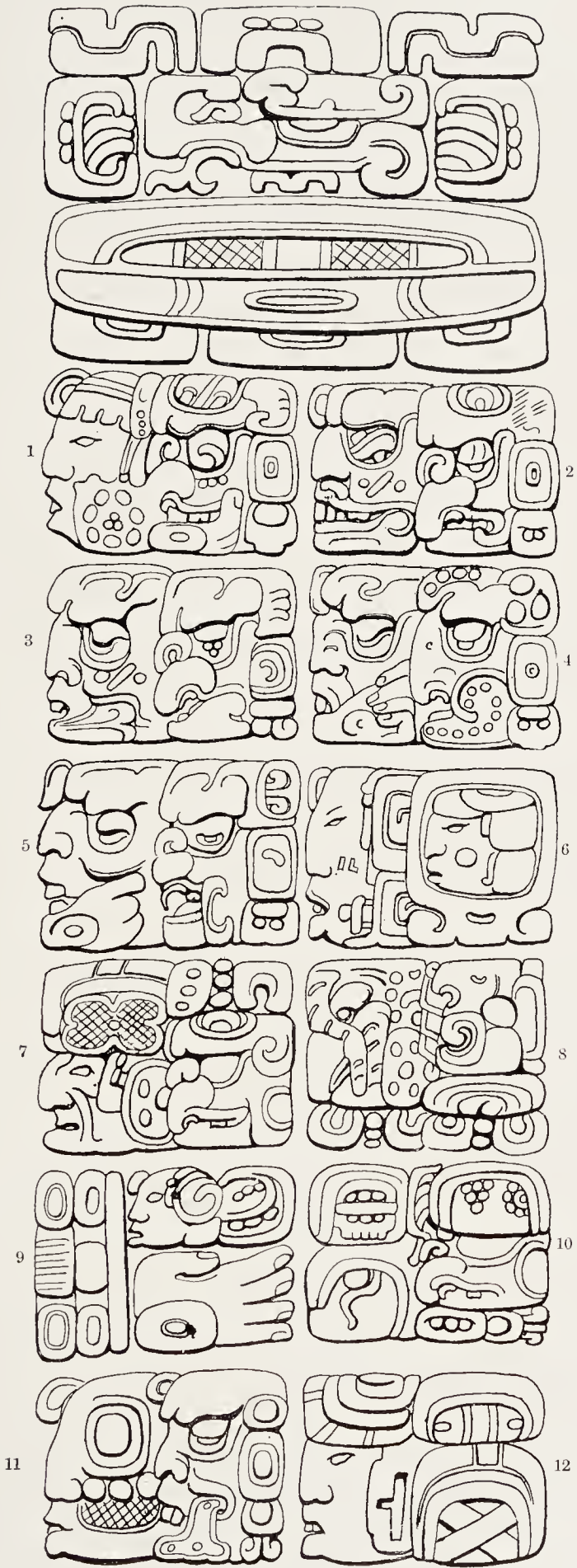
at this place, where the numerals are of the ordinary form, commence with 9 cycles.

As the numbers in the inscription on the east side of Stela E are all of the ordinary form, nothing in regard to the face numerals can be learned from it.

The numbers in the initial series on the east side of Stela F (plate LXXIII) are all face characters, including those attached to the terminal date. Goodman interprets them as follows: "54-9-16-10-18-20, 1 Ahan 3 Zip." As will be seen by reference to my former paper, the 18 chnens 20 days are to be understood and counted as 0 chnens 0 days, and we shall hereafter write them so. Goodman omits, probably by printer's mistake, the 9 cycles, but the other numbers which he gives make them necessary.

As none of the numbers in this case correspond with any on the west side of the same Stela, excepting the 9 cycles, the glyph for which is too nearly obliterated for determination, we gain nothing by comparison; and nothing can be learned from other inscriptions of this locality which present no face numerals; these are passed over without notice.

Turning to plate XLIV in part 12 of Maudslay's work we find drawings of the inscriptions on the "Monolithic Animal G." As the numerals in the initial series are face characters, with the exception of that attached to the month of the terminal date, and have not been noticed by Goodman in his work, I call attention to them (figure 123). As the cycle in most of the initial series at Quirigua appears to be numbered 9, we will assume that to be the number in this case. But this is not a mere assumption without any other basis, as the glyph is not inconsistent with that on the west side of Stela F and agrees with the type given (see figure 132) in having the circle of dots on the cheek. Although this does not amount to demonstration, it renders the interpretation highly probable. Having determined the cycle our examination is very much restricted. However, as we know as yet no way of determining the great cycle by an inspection of the symbol, our examination must extend to the three given by Goodman. But without other data the examination on this line is vain. Examining the series, we notice that the face glyph attached to the katin symbol immediately under the cycle is partially obliterated and as yet is unknown. Passing to the upper pair in the next group to the right hand, we notice that the numeral resembles somewhat closely that attached to the month (glyph 7) of the terminal date in the inscription on the west side of Stela F (plate LXXI), which was found to denote 5. The symbol on the monolith differs in having the skeleton jaw, which Goodman says denotes 10, though we have not as yet found the proof of this, and we therefore assume that it denotes 15 ($10+5$) (see figure 138*b*). The hand on the face immediately below, which is attached to the chuen glyph, as also on the glyph



INSCRIPTION ON THE EAST SIDE OF STELA F, QUIRIGUA
MAUDSLAY, PART 12, PLATE XL

attached to the symbol for days in the upper pair of the group to the right, denotes, according to Goodman, full count or 20 when days and 18 when chuens (see figure 143). However, I consider it, as heretofore stated, a symbol for naught. Immediately below the latter is the day (probably Ahau) of the terminal date, with the face symbol for 5, already determined, prefixed (figure 128*a*). The first glyph of the lower pair of the group to the right has the ordinary character for 3 prefixed. This we take to be the month symbol, though it is unusual and indeterminable by inspection. The series, therefore, so far as made out, is as follows: 54?-9-?-15-0-0, 5 Ahau 3 (month).

It is evident that the 5 Ahau of this series must be the beginning day of an ahau, as there are neither chuens or days, and hence it should be found in Goodman's "Archaic Chronological Calendar." Turning to this publication, we find that 5 Ahau 3 (month) can occur as the beginning of the 15th ahau in the 9th cycle in the following places only—53d great cycle, 9th cycle, 17th katun; 54th great cycle, 9th cycle, 4th and 17th katuns. In the first it falls in the month Pop, in the second in Yaxkin, and in the third in Muan. As the month symbol, so far as it remains, does not admit of interpretation as the first or second of these, we conclude that it must stand for the third if the date is within the range of Goodman's calendar. This gives as the series 54-9-17-15-0-0, 5 Ahau 3 Muan, which works out correctly by calculation.

The "full count" or "naught" symbols require some discrimination in our attempts to interpret them. In a series given by Goodman, as 54-9-17-15-18-20, or 54-13-20-20-18-20, 18 and 20, being so-called "full counts," should in every instance be counted as naught, and the cipher (0) should be introduced in their place; and this is true in every case where the symbols are used to represent prefixed numbers, except in one place. Where they are used to denote the day of the month, as 5 Eb 20 Zotz, they denote 20, but there are special characters used for this

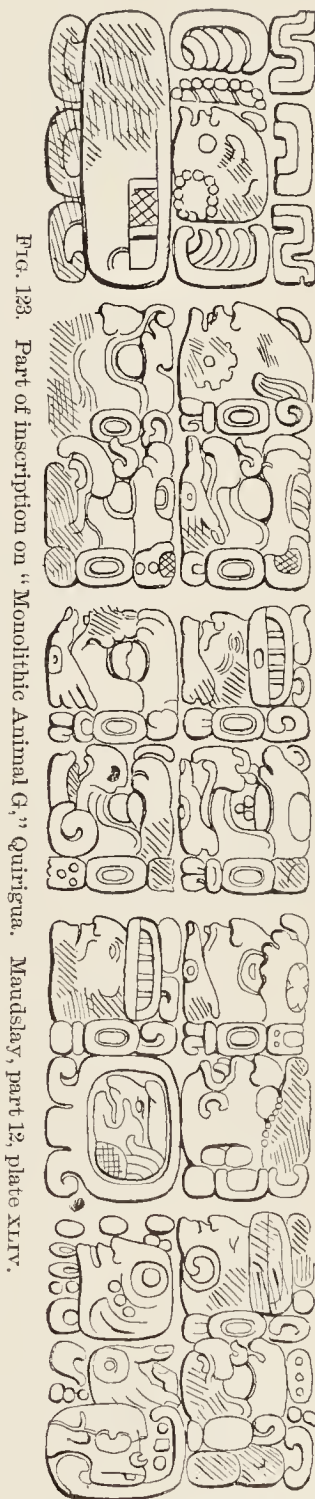


FIG. 123. Part of inscription on "Monolithic Animal G," Quirigua. Maudslayi, part 12, plate XLIV.

purpose, as is shown in figure 145. It appears probable also that the hand across the jaw in the face-forms of the cycle and great cycle is to be interpreted as indicating the use of 20 as a multiple, though in face-forms of prefixed numbers it undoubtedly signifies naught. Goodman is possibly right in insisting that these are not absolutely naught symbols, as is our 0, but are used to indicate that the count in the given denomination is complete and has been carried into the next higher denomination. Nevertheless they are—with the exceptions mentioned—equivalent to naught and must be so considered and used in calculating time and numeral series.



FIG. 124. Face numerals for 1.



FIG. 125. Face numeral for 2.

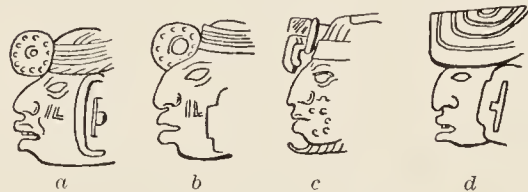


FIG. 126. Face numerals for 3.

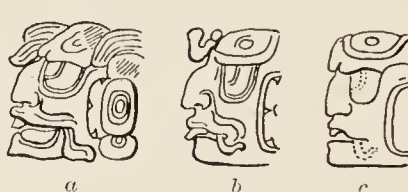


FIG. 127. Face numerals for 4.

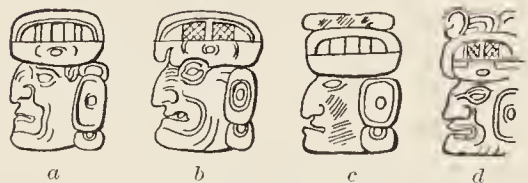


FIG. 128. Face numerals for 5.



FIG. 129. Face numerals for 6.

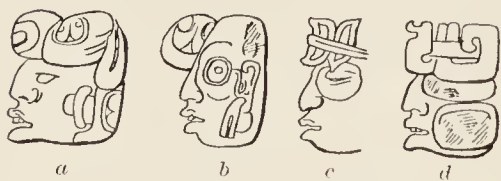


FIG. 130. Face numerals for 7.



FIG. 131. Face numerals for 8.

I insert here, in figures 124 to 145 inclusive, the types of face numerals selected by Goodman from the inscriptions. I have found them to be correct, with some two or three exceptions in regard to which there is considerable doubt; these will be noticed in the proper connection. Some additional examples will appear as we proceed.

The next inscription of this locality to which attention is called is that on Stela J (see Maudslay's drawing, part 12, plate XLVI, our plate LXXIV). All the numbers of the initial series except that of the day of the month in the terminal date are face characters. The series

as given by Goodman is as follows: ?-9-16-5-0-0, 8 Ahau 8 Zotz. The number of the great cycle is omitted, though it is necessarily 54 according to his system. He says there are no other reckonings in the inscription, but this is a mistake, as there are two more numeral series, each followed by a distinct date. These, however, afford no assistance in determining the initial day, as they do not connect with it; moreover, a large number of glyphs intervene.

All the evidence bearing on the value of the face numerals in this instance may be stated as follows: the symbol connected with the cycle, interpreted 9, shows the distinguishing features of the others



FIG. 132. Face numerals for 9.

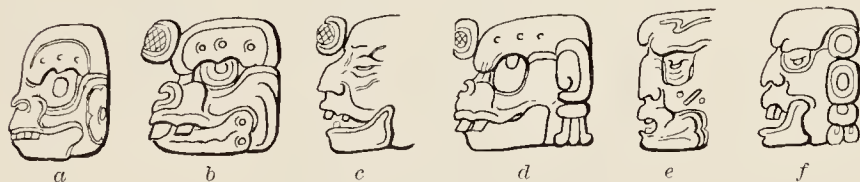


FIG. 133. Face numerals for 10.



FIG. 134. Face numeral for 11.

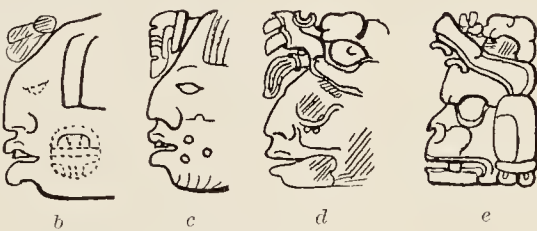


FIG. 135. Face numerals for 12.



FIG. 136. Face numerals for 13.

noticed which are interpreted 9. This, taken in connection with the fact that most of the inscriptions of this locality begin the initial series with 9, renders the interpretation probable. We have as yet no evidence that 16 is the correct rendering of the character attached to the katun glyph, Goodman's example (figure 139*b*) being the very symbol found here; but the 5 attached to the ahau glyph agrees with that determined from the inscription on the west side of Stela F, and therefore may be accepted as correct. The face number attached to the day (Ahau) of the terminal date, which is interpreted 8, is as

yet undetermined in our investigation; it is *c* of our figure 131. The day of the month and the month (8 Zotz) are distinct and easily recognized, the number being of the usual form. In regard to the chuen



FIG. 137. Face numeral for 14.

and day symbols, all we can say is that the hand across the face which appears to indicate full count (18 and 20) or naught (0) is seen in each of the attached glyphs. Assuming this to be correct, it follows that the date 8 Ahau 8 Zotz must be the first day of a 5th ahau.

Turning in Goodman's Archaic Chronological Calendar to the 9th cycle of the 53d great cycle, we find that 8 Ahau 8 Zotz is not the beginning of any 5th Ahau in this cycle nor in the 9th cycle of the 55th great cycle, but is the beginning of the 5th ahau of the 16th katun in the 9th cycle of the 54th great cycle. Even omitting the number of the day Ahau we can reach the same result from the data given, and that result only. The evidence therefore appears to be sufficient. This gives one example of the face character for 16 (see figure 139 *b*). As to the value and reliability of Goodman's tables

in the respect noticed I will speak hereafter; at present I assume them to be reliable, and I may state here that they may be

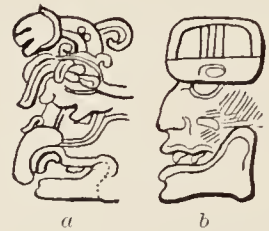


FIG. 138. Face numerals for 15.



FIG. 139. Face numerals for 16.

accepted, so far as our present tests are concerned, as correct in regard to the relation of the several time periods up to and including the cycle—without, however, accepting his theory in regard to the great cycle or the number of

cycles forming one of these great periods.

We must therefore accept as determined with reasonable certainty the value of the following face numerals: that on Stela J (glyph 1, Maudslay's plate XLVI, our plate LXXIV) prefixed to the cycle glyph, interpreted 9; that (glyph 3) affixed to the katun glyph, interpreted 16; that (glyph 5) prefixed to the ahau glyph,



FIG. 140. Face numerals for 17.

interpreted 5; those (glyphs 7 and 9) prefixed to the chuen and day glyphs, interpreted full count or naught; and that (glyph 11) prefixed to the day of the terminal date (Ahau, in this instance), interpreted 8. One distinguishing characteristic of the symbol for 9 is the circle of



INSCRIPTION ON THE BACK OF STELA J, QUIRIGUA
MAUDSLAY. PART 12, PLATE XLVI

dots on the cheek (figure 132); two characteristics of the symbol for 16 are the skeleton jaw and the hatchet in the eye (figure 139); those of the symbol for 5 are the ahau symbol on the head and the absence of the skeleton jaw (figure 128); that of the symbol for full count or naught is the hand across the face or lower jaw (figure 143); those of

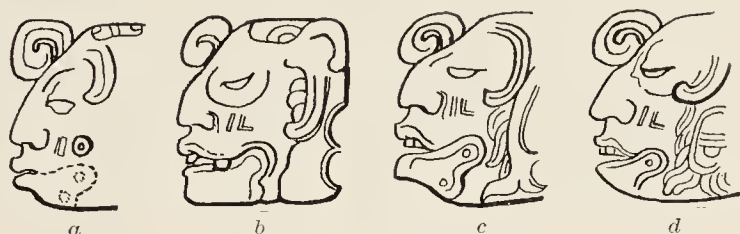


FIG. 141. Face numerals for 18.

the symbol for 8 do not appear to be well defined—Goodman says they are the lobed ear ornament projecting on the cheek and the form of the forehead ornament, but neither of these appears to be exceptional.

It should be stated that by counting forward in each of the given examples from the initial date (4 Ahau 8 Cumhu) the number of days indicated by the numeral series we will reach the terminal date.

Our next reference is to the inscription on Stela A, Quirigua, the drawing of which is given in plate VII, part 11 of volume II, Maudslay's *Archaeology* (our plate LXXV).

In this instance the numerals attached to the cycle, katun, and ahau, and the month of the terminal date of the initial series are of the ordinary form, and those attached to the chuen, day and the day of the terminal date are either face forms or unusual forms. The series as given by Goodman is 54-9-17-5-0-0, 6 Ahau 13 Kayab, which is certainly correct, as the data given are sufficient, as has been shown, to determine the series. It agrees with Goodman's tables and also with calculation.



FIG. 142. Face numerals for 19.

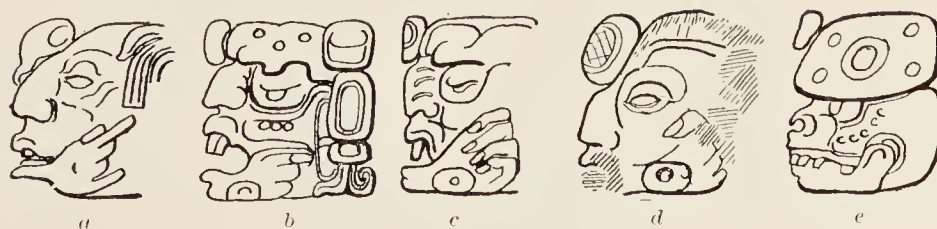


FIG. 143. Face numerals for 20.

By this we ascertain that the unusual numerals (glyphs 4 and 5) prefixed to the chuen and day symbols, each of which consists of a scroll above, a hand in the middle, and a bean-shaped character below, denote naught (figure 144, number 7). The face numeral prefixed to the day Ahau (figure 129 b) resembles that denoting 16 (see figure

139 *b, c*), excepting that it is without the skeleton jaw, thus apparently confirming Goodman's statement that this characteristic has the value of 10. In figure 144 are shown some forms of the symbols for naught (0). Numbers 1, 2, 3, 4, 5, and 6 in some of the types are of frequent occurrence in the inscriptions, as are also numbers 7 and 8.

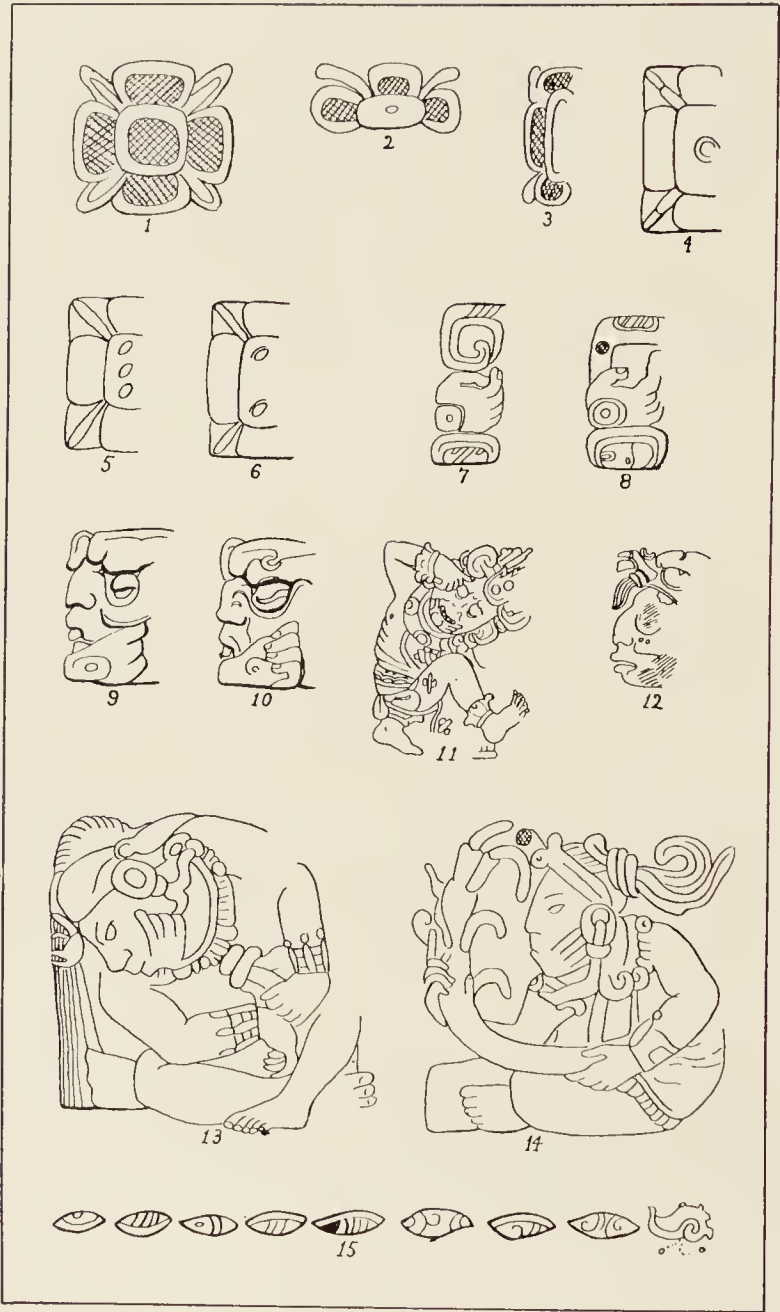


FIG. 144. Symbols for 0, or full count.

Numbers 9 and 10, which show the hand across the lower jaw, also represent a common type. Number 12 has been found only in the inscription on the Palace steps, Palenque. Number 11 is from Monolithic Animal B, Quirigua, and numbers 13 and 14 are from Stela D,



INSCRIPTION ON THE EAST SIDE OF STELA A, QUIRIGUA

MAUDSLAY, PART 11, PLATE VII

Copan. The small figures of number 15 are from the Dresden codex, and represent a common type; the slight variations in detail are numerous and appear to have no significance.

In figure 145 are shown the symbols for full count, or 20, not shown in figures 143 or 144. *A*, *b*, *c*, and *d* are more or less common in all the codices; *e* is from the Dresden codex; *f*, *g*, *h*, and *i* are from the left slab, Tablet of the Cross, Palenque.

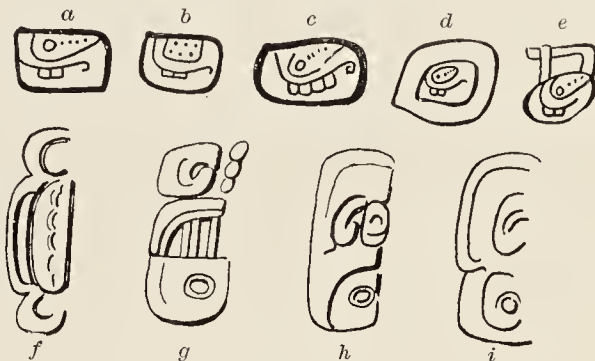


FIG. 145. Symbols for full count, or 20.

The inscription on the east side of Stela C presents some particulars worthy of notice (see figure 146). The prefix to the cycle symbol

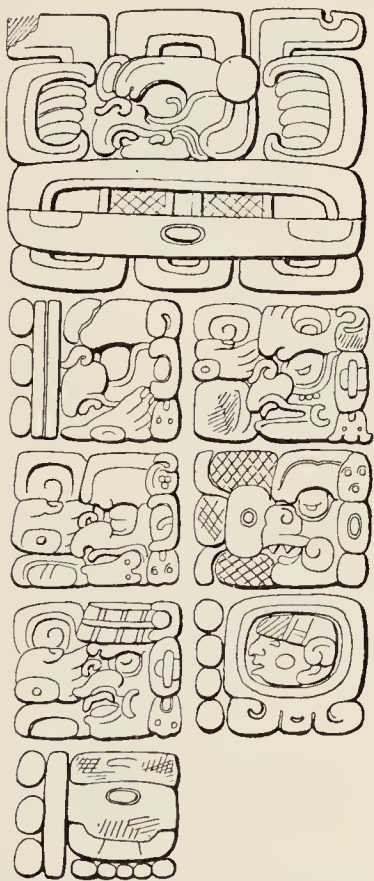


FIG. 146. Part of inscription on the east side of Stela C, Quirigua. Maudslay, part 11, plate XIX.

is 13 in the ordinary form; those to the katun, ahau, and day are of the coil and hand form, above described as indicating full count, or, in other words, naught; that to the chuen is of the usual form for full count in the inscriptions (see number 3, figure 144). The date is 4 Ahau 8 Cumhu with ordinary numerals. Therefore the series, according to Goodman's method of writing, will be ?-13-20-20-18-20, 4 Ahau 8 Cumhu, which is as he gives it, excepting that he places it in his fifty-fourth great cycle. Our method of writing it would be 53-13-0-0-0-0, 4 Ahau 8 Cumhu. I give 53 as the great cycle, according to Goodman's method of numbering these periods, as by counting back 13 cycles, or 1,872,000 days, from 4 Ahau 8 Cumhu we reach 4 Ahau 8 Zotz, the first day of his fifty-third great cycle. His remark in regard to it is: "This date is the beginning of the fifty-fourth great cycle." As he interprets the great cycle 54, he virtually makes the series 54-0-0-0-0-0. It must be borne in mind, as will be seen by reference to my former paper, that instead

of counting 20 eyes to the great cycle, following the vigesimal system, which I believe to be correct, he counts 13. However, this

subject will again be referred to. At any rate, we find further confirmation of the signification of the number symbol—the combined coil, hand, and bean shaped character—in this inscription.

The inscription on the west side of Stela C (figure 147 *a*) is interpreted by Goodman as follows: 9-1-0-0-0, 6 Ahau 13 Yaxkin, the number of the great cycle being omitted. As the numerals attached to the cycle, katun, and day and month of the terminal date are of

the usual form, and the symbols for full count, or naught, attached to the ahau and month glyphs are of the usual type, we have sufficient data to determine the face character attached to the day glyph. Omitting from consideration the number attached to the day symbol and counting back from 6 Ahau 13 Yaxkin, year 4 Lamat,

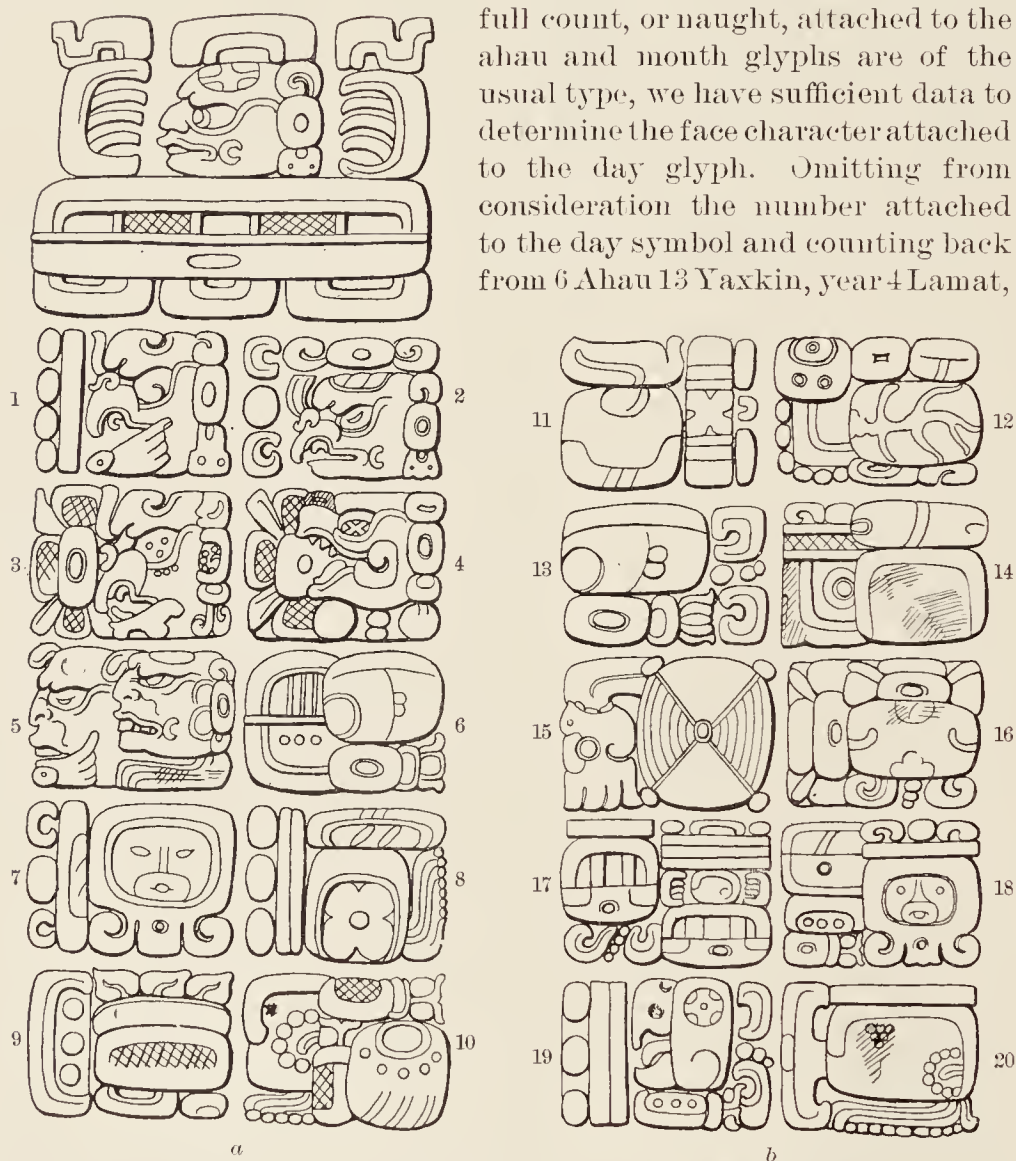


FIG. 147. Part of inscription on the west side of Stela C, Quirigua. Maudslay, part 11, plate XIX.

9 cycles and 1 katun, or 1,303,200 days, according to the method given in my former paper, we reach 4 Ahau 8 Cumhu, the first day of the fifty-fourth great cycle. Turning to Goodman's Archaic Chronological Calendar, to the ninth cycle of the fifty-fourth great cycle, we find that 6 Ahau 13 Yaxkin is the first day of the first katun. Thus it is seen that both the tables and calculation agree with the interpretation of the series. By this we have a further confirmation of the

interpretation full count (or properly 0) of the face numeral with the hand over the lower jaw. It may be mentioned here that Maudslay agrees with me in designating these so-called "full counts" as given by Goodman as "no count," or, in other words, naught (see his text, part 11, page 9).

Referring to inscriptions in other localities, the following facts are noted in reference to the value of the different face numerals: the initial series of the Foliated Cross at Palenque (see figure 2, previous paper) appears to be as follows: 54-1-18-5-4-0 to 1 Ahan 13 Mac. Following this date, after some intervening glyphs, is the brief numeral series 14 chuens 19 days, immediately after which comes the date 1 Cauac 7 Yax.

Counting back 14 chuens 19 days from the latter date, we reach 1 Ahau 13 Mac, the terminal date of the initial series. This gives the value 1 to the face glyph attached to the Ahau symbol. This face glyph (figure 124*b*) agrees in its features, excepting the ear pendant, with the face glyph attached to the cycle symbol (figure 124*a*), showing it to be 1, which agrees with the above interpretation. As the face glyph attached to the ahau period symbol agrees with the symbol we have heretofore interpreted 5 (see figure 128*a*); and the number attached to the month symbol is of the ordinary form; and that attached to the day glyph has the hand across the lower jaw, we have the following numbers of the series: ?-1-?-5-?-0, 1 Ahau 13 Mac.

These items are not sufficient to give the remaining numbers of the series; but assuming that it falls in the 54th great cycle, as is most probable, the other numbers will be as given above. As the face character attached to the chuen symbol, interpreted 4 (figure 127*b*), presents some features of the one interpreted 4 on the west side of Stela F at Quirigua (left part of glyph 4, plate LXXI), and this will suffice to determine the other numbers, we are perhaps justified in concluding that the series is given correctly. That the face character attached to the katun symbol (figure 155*c*), which is interpreted 18, is some number greater than 10 is shown by the skeleton jaw.

Turning to the inscription of the Temple of the Sun, as shown in Maudslay's plate LXXXIX, part 10 (see plate XLI, Nineteenth Annual Report of the Bureau of American Ethnology, 1900), where the numbers of the initial series are all face characters except those designating the day of the month in the terminal date, we will try to determine them from the data so far obtained. As those attached to the cycle (figure 124*c*), katun (figure 141*c*), and ahau (figure 128*b*) symbols are evidently the same as those in the inscription of the Foliated Cross, and the day of the terminal date is ? Cimi 19 Ceh, we have the following items of the series: ?-1-18-5-?-?, ? Cimi 19 Ceh.

These data are not sufficient to determine the remaining numbers. One other item is necessary for this purpose. Assuming the great cycle to be that commencing with the day 4 Ahau 8 Cumhu, the

so-called 54th, the remaining numbers may be determined thus: Cimi may be the 19th day of the month only in the years in which Ahau is the 13th day of the month. By turning to Goodman's "Archaic Chronological Calendar," 54th great cycle, cycle 1 and katus 18, we see that the 5th ahau begins with the day 12 Ahau 13 Chen. Turning to his "Archaic Annual Calendar," we find that 12 Ahau 13 Chen falls in the year he numbers 34 (equivalent to the year 9 Lamat in my condensed calendar). Cimi is the 19th day of the month in this year, but the month can not be determined until the day number attached to Cimi is ascertained. As the face numeral attached to the chuen symbol in the inscription is without the skeleton jaw we infer that it does not exceed 9, and as it has none of the signs of full count or naught it can not be 0. As Cimi comes 6 days after Ahau, then we must count forward in the table of the year 34 until we reach the 19th day of the month Ceh. This count we find to be 3 months and 6 days, and the number attached to Cimi is 13. Therefore the entire series is 54-1-18-5-3-6, to 13 Cimi 19 Ceh, which is as it is given by Goodman. The weak point in this solution is the assumption of the 54th great cycle. Even without this, we can, by a range of nine trials, determine that no other numbers than those given can be found within the scope of Goodman's three great cycles (53d, 54th, and 55th), but this, though strengthening the conclusion, is not absolute demonstration, as the objection to his method of counting the cycles, hereafter noticed, and the uncertainty as to the scope of his tables, come into the problem. As will be seen later, the only certainty in regard to the tables of his "Archaic Chronological Calendar" is the orderly and correct succession of dates and periods and the fact that 4 Ahau 8 Cumhu is the first day of a great cycle. Assuming for the present that the series has been correctly determined, we gain evidence as to the value of two additional face numerals, 3 (figure 126*a*) and 6 (figure 129*a*).

Goodman's interpretation of the initial inscription of the Tablet of the Cross, which is 53-12-19-13-4-0, 8 Ahau 18 Tzec, is not satisfactory. The face numeral attached to the cycle symbol, which he interprets 12 (figure 135*a*) has, as a superfix, a figure very much like the superfix to the face character which he has correctly interpreted 5 (as is shown by the evidence I have presented) (figure 128*a*). In his representation of face numerals no one save those denoting 5 or 15 have a superfix of this kind, excepting one for 12, and that one is the character of this inscription (figure 135*a*). Moreover, it lacks the skeleton jaw, which is true of some others above 10 as given by him. As has been shown in my previous paper, where this inscription is discussed at length, and as is admitted by Goodman, there is no connection between the terminal date of the initial series and any of the dates which follow, if the numeral series which intervene be taken as given in the inscription.

In addition to the suggestions offered by Goodman and those presented in my previous paper in regard to correcting the manifest error somewhere in these series, the following is added as a possible solution: Change the terminal date of the initial series from 8 Ahau 18 Tzec to 1 Ahau 8 Muan, and the following numeral series will then connect the succeeding dates with it, and the 1 Ahau 18 Zotz will come 1-8-0 (1 ahau 8 chuens) or 520 days after the terminal date of the initial series, instead of being placed back of it as Goodman's correction requires. This, however, will slightly change the initial series from the numbers given by Goodman. By referring to the inscription as given in Maudslay's drawing, we notice at C5 the symbol for 13 cycles (figure 148). As this is not connected with a series, and follows immediately after the date 4 Ahau 8 Cumhu, we are justified in interpreting it as an indication that up to this point 13 cycles have been passed over from the initial date of the inscription, which must be 4 Ahau 8 Zotz. The calculation is correct. Subtracting the series 8-5-0 (1D 2C) from 13 cycles the remainder is 12-19-11-13-0.

$$\begin{array}{r}
 13-0-0-0-0 \\
 \quad 8-5-0 \\
 \hline
 12-19-11-13-0
 \end{array}$$

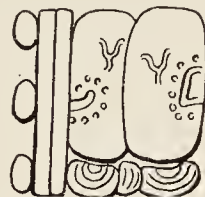


FIG. 148. Symbol for 13 cycles. Maudslay, part 10, plate LXXV, glyph C 5.

If this correction be justified the initial series will be 53-12-19-11-13-0, 1 Ahau 8 Muan, which will fit into Goodman's tables. The chief objection to this is that it compels us to assume that the aboriginal artist made a mistake in his calculation, as the month symbol is clearly Tzec and the face numeral shows the skeleton jaw, indicating that the number as given is above 10. However, we must admit that the error has not, as yet, been satisfactorily explained, and consequently the value of but two of the face numerals—those attached to the cycle and katun glyphs—can be determined by the inscription. Twelve (see figure 135*a*) for the cycle and 19 (figure 142*a*) for the katun, as given by Goodman, must apparently be accepted on any theory as to the correction. It will be observed that the symbol attached to the ahau glyph, which Goodman interprets 13 (figure 136*d*), is widely different from any of the other symbols for 13 given by him, as is seen by reference to our figure 136, which is a copy of the examples given by him on page 49 of his work. So far, therefore, as comparison shows, it may as well be interpreted 11 as 13; but, in fact, is more like 19 (see figure 142) than either. Nor can his interpretation (4) of the character attached to the chuén symbol be clearly sustained by comparison, though it must be conceded that it does not resemble the determined types of 13.

The initial series on Stela D of the Copan inscriptions (Maudslay, plate XLVIII, part 2, our plates LXXVI and LXXVII) is peculiar in

having the usual face characters replaced by full forms. The cycle symbol (glyph 1) is composed of a human figure (the numeral) and a bird apparently of the parrot species (the cycle); the katun (glyph 2) of the human form (the numeral) and a bird of a rapacious species (the katun); the ahau (glyph 3) of the human form (the numeral) and a nondescript animal (the ahau); the chuen (glyph 4) of a human form (the numeral) and a frog-like animal (the chuen); the day (glyph 5) of two human forms, that to the right with the monkey-like face turned backward (the day); the day of the date (glyph 6) (presumably Ahau) of a human form (the numeral) with a cartouch inclosing another form (the Ahau); the month of the date (glyph 13, plate LXXVII) of a human form (the numeral) and a full-formed leaf-nosed bat (the month).

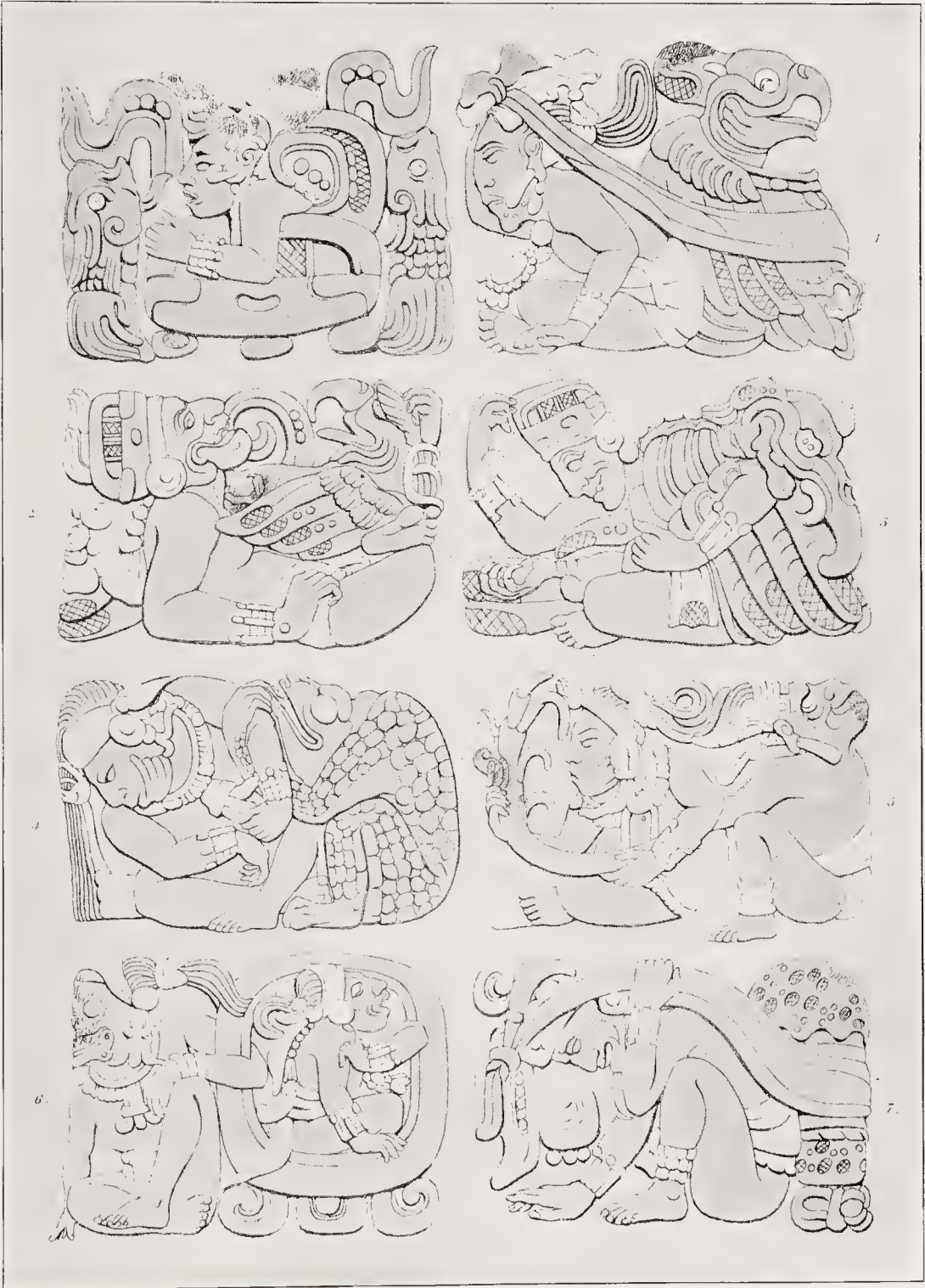
Goodman's interpretation of the series is as follows: 54-9-5-5-0-0, 4 Ahau 13 Zotz. The dots on the chin of the human face of the cycle symbol (plate LXXVI, glyph 1) and other characteristics probably justify us in interpreting it as 9. The hand across the lower



FIG. 149. Type of face numeral.

jaw in the chuen symbol (plate LXXVI, glyph 4) and day symbol (plate LXXVI, glyph 5) indicate full count or naught (0). But Goodman's rendering 5 and 5 of the number characters of the katun (plate LXXVI, glyph 2) and ahau (plate LXXVI, glyph 3) symbols is questionable, as the skeleton jaw denoting 10 is quite distinct in the former and is not present in the latter. The rendering is therefore inconsistent with Goodman's own statements in regard to the characteristics of the face numerals, and must have been reached in some other way than by inspection of the glyphs. If the figures with ahau symbols on the head are face numerals, and this must be admitted, then that of the katun (glyph 2) should be 15, and that of the ahau (glyph 3) should be 5, if Maudslay's colored drawing is correct. However, it must be admitted that the drawing of the face numeral prefixed to the katun symbol is very doubtful. In figure 149 is given a drawing of the head alone, made from Maudslay's plate XLIV, which is the autotype of the same inscription.

This inscription is the most interesting one in some respects that has been found in Mayan ruins. Entire bodies, instead of conventional heads, are given, and though they are to some extent grotesque, yet they seem to indicate the aboriginal idea of the origin of these symbols. Maudslay's happy idea of distinguishing the prefixed numerals from the period symbols (cycle, katun, etc.) by difference in color brings out very clearly the forms and characteristics of the latter symbols. The cycle and katun symbols are both rapacious birds; the former owl-shaped, with a crest; the latter eagle-shaped, with feathers hanging over the front of the head. The ahau symbol is the skeleton form of a nondescript bird-like animal with a large



PART OF INSCRIPTION ON STELA D, COPAN
MAUDSLAY, PART 2, PLATE XLVIII



PART OF INSCRIPTION ON STELA D, COPAN

MAUDSLAY, PART 2, PLATE XLVIII

fang; the chuen glyph is a frog-like animal. The month symbol of the date (glyph 13, plate LXXVII) is, as stated above, a leaf-nosed bat with a human face. As the name of the latter, Zotz, or "Bat," corresponds with the form, it is possible that the forms of the other symbols have some reference to the names. However, I am unable to point out this reference; though possibly as "uinal" in Maya signifies "month" or "period of 20 days," and "uo" "frog," the symbol may have some reference to the name. Be this as it may, it will be seen by reference to figures 163 and 164, showing the types of the ahau and katun symbols, that the face forms retain to a large extent the bird-like features, one of the katun symbols, figure 164*a*, having the feather fringe over the forehead. We notice also in some of the symbols of both the ahau and katun little patches of cross-hatching, which are feather marks in the full forms of Stela D.

These facts are noticed in passing merely to call the attention of students to them as possibly forming some clew to the relation between these symbols and what is represented by them.

Attention is called next to the inscription on Stela I, Copan. The numerals attached to the cycle, katun, ahau, and chuen symbols are of the ordinary form; that to the day glyph is of the disk and hand type (figure 144) denoting naught (0); and that to the day (Ahau) of the terminal date, the face character with the ahau headpiece denoting 5. Whether the month symbol is distinguishable, or is one of the obliterated glyphs which follow, as Goodman asserts, is doubtful. The series is therefore ?-9-12-3-14-0, 5 Ahau ? (month). Goodman says 54-9-12-3-14-20, 5 Ahau ? (month); leaving the month blank, but adds that we know it must be 8 Uo.

The correctness of the last statement may be questioned on the following grounds: Taking, in Goodman's own tables, the 55th great cycle, 9th cycle, 12th katun, and 3d ahau, we find that the first day of this ahau is 11 Ahau 8 Uo; by counting forward 14 months from this date we reach 5 Ahau 8 Pax, a result which calculation shows to be correct, the initial date of this great cycle being 4 Ahau 3 Kankin. The positive determination depends therefore on the proper determination of the great cycle, or of its initial day, for his numbering of these supposed periods, as we shall soon see, is without proper grounds.

The initial series of the inscription on the east side of Stela P (figure 150), same locality as the preceding, is given as follows: 54-9-9-10-0-0, 2 Ahau 13 Pop. The numbers attached to the cycle, katun, and ahau are face characters, those attached to the chuen and day symbols are of the type shown in numbers 4, 5, and 6, figure 144, but much abbreviated, and those of the terminal date are of the ordinary form. The month symbol, which Goodman interprets Pop, is apparently a variation of the usual type. As enough of the prefix to the chuen symbol remains to indicate full count or naught (0), it may be assumed that the prefix to the day symbol, of which there seems to

be a slight remnant, is the same; therefore the terminal date will be the first day of an ahau. The skeleton jaw in the prefix to the ahau symbol, not well shown in Maudslay's drawing (plate LXXXIX of his



FIG. 150. Part of inscription on the east side of Stela P, Copan.

work, part 4), but distinct in his photograph, would indicate 10 or some number above 10 (see figure 150). The face numerals of the cycle and katun are evidently the same, and one of them shows quite distinctly

the circle of dots on the cheek, indicating 9 (see figure 132). Therefore the series so far as satisfactorily made out—assuming the number attached to the day Ahau to be 2—is as follows: ?-9-9-?-0-0, 2 Ahau 13 Pop. This is sufficient to determine the series, and shows the above rendering to be correct.



FIG. 151. Part of inscription on the east side of Stela P, Copan. Maudslay, part 4, plate LXXXIX.

Although the drawings in Maudslay's work are in most cases of unusual excellence, giving details with wonderful accuracy, that of this inscription and the one on altar Q (part 4, plate XCIII) are not up to the usual standard, failing in some instances to bring out as clearly as might be done some of the minor details. There is some

doubt as to the value of the face numeral prefixed to the ahau symbol (A2, figures 150 and 151), as it is unusual, being in some respects unlike any other face numeral that I have observed in the inscriptions. Seler (*Zeitschrift für Ethnologie*, Heft 6, 1899, page 722) interprets it 13, and gives as the terminal date 3 Ahau 3 Uayeb. This would make the series, omitting the great cycle, 9-9-13-0-0, 3 Ahau 3 Uayeb; however, the number attached to the month symbol is certainly 13. If this series is counted from 4 Ahau 8 Cumhu, it will reach 3 Ahau 3 Uayeb in the year 5 Ezanab. The number attached to the day Ahau is very uncertain, seeming more like 1 or 3 than 2; apparently 1. I have therefore given an exact copy of Maudslay's photograph (figure 151), and a carefully made drawing (figure 150), using Maudslay's and Seler's drawings and the photograph (autotype) for this purpose. I am rather inclined to the opinion that Goodman's rendering is correct. It seems that Seler has been influenced in his determination of the number placed over the Ahau symbol by Maudslay's drawing. His interpretation is not justified by the photograph, which indicates "1 Ahau" instead of "3 Ahau," making the date 1 Ahau 13 Uo, or 1 Ahau 13 Pop.

The whole inscription, as well as the inscription on the front and back of the same monument, is strange, and, as will be noticed farther on, shows some of the features of the Chichen Itza inscriptions.

It is perhaps unnecessary to follow this subject further, as it is apparent that the value of the face symbol and other numeral symbols can be satisfactorily obtained. It appears that Goodman's determinations, where the data are sufficient, are as a rule correct; though there are a few cases, as has been shown, where his rendering is doubtful, and some where the series given are largely guess work, the data being insufficient. When the number of the great cycle is a necessary factor, another question arises, which will be discussed farther on.

Before discussing the numbers of the cycles and great cycles, which subject was referred to in my previous paper, I will notice some of the secondary numeral series of the Quirigua inscriptions not at hand when my previous paper was written.

SECONDARY NUMERAL SERIES OF THE QUIRIGUA INSCRIPTIONS

Returning to the inscription on the west side of Stela F (plate LXXI), we pass over the first subordinate series (glyph 16), leading on to 6 Cimi 4 Tzec (glyphs 18 and 19), as this has already been noticed. At glyph 25 follows a date, 3 Ahau 3 Mol, but without any recognizable intermediate numeral series, though there are some numbered glyphs. Passing on we find at glyph 29 the date 4 Ahau 13 Yax, and immediately following (glyph 30 and first half of 31) the numeral series 3 days, 13 chuens, 16 ahaus, 1 katun, and following this two

dates, 12 Caban 5 Kayab (the same as the terminal date of the initial series) and 1 Ahau 3 Zip, though the number attached to the day in the latter is not the ordinary symbol if intended for 1 (figure 152). Counting the series given forward from 3 Ahau 3 Mol and 4 Ahau 13 Yax brings us to no given date; nor will counting back from 12 Caban 5 Kayab reach any previous given date. If, however, we count back from 1 Ahau 3 Zip, we reach 12 Caban 5 Kayab, showing that the connection is made with the terminal date of the initial series, as given by Goodman. It would seem from this that the insertion of this date, after this second numeral series, is for the purpose of showing that the count is to be made from this date, as we found in our preceding paper to be true in some instances.

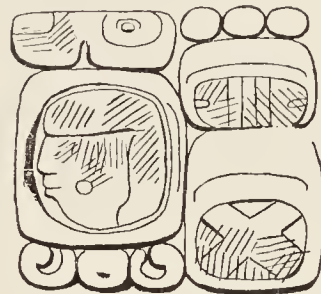


FIG. 152. Glyph 33, west side of Stela F, Quirigua. Maudslay, part 12, plate XL.

Our next reference is to the inscription on the east side of Stela F (Maudslay's plate XL, part 12). Here the initial series (plate LXXIII), as heretofore stated, is 54-9-16-10-0-0, 1 Ahau 3 Zip. Goodman, in his comment (page 125), says:

The glyphs that immediately follow are so fantastic and unfamiliar that I can make nothing of them until the sign indicating a date to be some score days in the 19th katun is reached. The date is 5 Ahau 13 Mol [glyph 24]. As that begins the 1st ahau, the number of score days indicated must be 18. Two unintelligible glyphs follow, succeeded by what I believe to be this reading: 3 cycles, 8 katuns, and 19 ahaus, a reckoning embracing 26 calendar rounds and extending 360 8-score days into the 13th cycle, to 1 Ahau 13 Yax, the beginning of a 360-bissextile count and of a katun also.

It is somewhat difficult to understand these statements, but I will try to explain them, as I desire to offer one or two criticisms. The



FIG. 153. Part of inscription on the east side of Stela F, Quirigua. Maudslay, part 12, plate XL.

actual interval between 1 Ahau 3 Zip, the terminal date of the initial series, and 5 Ahau 13 Mol (if the first following occurrence of this date be assumed as the one intended) will be 18,360 days, or 2 katuns, 11 ahaus. This will bring us to 5 Ahau 13 Mol, the first day of ahau number 1 in the 19th katun of cycle 9 (as numbered by Goodman)—the one now under consideration. What he means by 18-score days is that the count extends 360

days into the 19th katun, bringing us to the commencement of the second ahau, which, according to his method of numbering, is 1.

For some unexplained reason, Goodman makes no mention of the numeral series between the terminal date of the initial series 1 Ahau

3 Zip and 5 Ahau 13 Mol. This, unless I am wrong in my interpretation, is found in glyphs 21, 22, and 23 (figure 153), as numbered by Maudslay. The prefixed numerals with one exception (that prefixed to the ahau) are of the ordinary type. However, as the exception, which is a face numeral, shows the hand across the lower jaw we must assume, according to what has been shown, that it denotes full count or naught (0). With this assumption, the series appear to be 3 days, 11 ehuens, 0 ahaus, and 19 katuns, or $-19-0-11-3$, the number of ehuens being uncertain; but this series will not connect any preceding with any following date. Could this have been Goodman's reason for omitting notice of the series?

It is noticeable also that the symbol he interprets 5 in the date 5 Ahau 13 Mol (glyph 24, figure 153) is precisely the same as the one he interprets 1 in the date 1 Ahau 3 Zip in the inscription on the west side of this stela (glyph 33). In the next place it is exceedingly doubtful, judging from an inspection of the characters, whether his supposed series "3 cycles, 8 katuns, and 19 ahaus" can be found in the space indicated—that is between glyphs 24 and 29. There is not in it, with one exception, a single glyph that in any way resembles any of the forms of time periods he has noticed. The exception is the first part of glyph 26, which is like the ordinary form of the chuen symbol; but the character over it is like that over Ahau in the date he gives as 5 Ahau 13 Mol, elsewhere interpreted as 1. There is a numeral, 13, of the ordinary form over the first part of glyph 28, but there is no 13 in the series he gives. We take this series, therefore, to be purely imaginary, made up from his tables. According to Maudslay's drawing, the month symbol in the following date—1 Ahau 13 Yax—is really the symbol for Yaxkin. But an examination of the photograph does not bear out the drawing, the glyph being as much like the Yax as the Yaxkin symbol.

According to his statement, this imagined series extends "360 8-seore days into the 13th eyele to 1 Ahau 13 Yax." He must, of course, allude to the 13th eyele of his 55th great cycle; with this understanding his count is correct, if he had anything to base it on.

We turn next to the inscription on the west side of Stela E, the drawing of which is shown in Maudslay's plate XXXI, part 12. The terminal date of this initial series (see plate LXXII), the number of ahaus being corrected from 12 to 13, as already noticed, is 12 Caban 5 Kayab. The first numeral series which follows is in glyphs 14 and 15 (figure 154*a*), and is 6-13-3 (reversed), equal to 2,423 days. The date which follows (glyph 16) is 4 Ahau 13 Yax. The count is correct, as 2,423 days from 12 Caban 5 Kayab, year 13 Ben, bring us to 4 Ahau 13 Yax, year 7 Lamat. The next series is found in glyph 18 and, according to the method of reading the ehuens and days so far followed—that is, counting the number at the left side of the ehuen symbol as days and that above it as ehuens—is, in reverse order, 1-6-14, but

Goodman, without any explanation, changes it here to 1-14-6. The date following (glyphs 19 and 20), is 6 Cimi 4 Tzec. The time given in this instance will not reach from one of these dates to the other. As Goodman is certainly right in his correction in this instance, if the date 4 Ahau 13 Yax be correct, we will examine it. The initial series of this inscription, including the terminal date, is, when the correction noted has been made, precisely the same as that of the inscription on the west side of Stela F, and the first following date there is the same as the

second here, 6 Cimi 4 Tzec.

As the intervening series is too short to allow for a second return of the latter date, it is evident that the numeral series must be the same. As that of Stela F is 13-9-9, then by subtracting, in the inscription on Stela E, the 6-13-3 extending from 12 Caban 5 Kayab to 4 Ahau 13 Yax, from this series (13-9-9) the remainder, 6-14-6, must give the lapse of time from 4 Ahau 13 Yax to 6 Cimi 4 Tzec, the third date, and calculation shows that it does. Therefore the correction from 1-6-14 to 1-14-6, and the 1 to 6, giving 6-14-6, may be accepted as justifiable if the date 4 Ahau 13 Yax be correct. At any rate, it is certain that this change is correct or that an equivalent change in the preceding series 6-13-3, must be made and the date altered to suit. I am therefore inclined to accept the correction made by Goodman.

Following the last date at glyphs 21 and 22 (figure 155) is the series 15 days 18 chuens 1 ahau 1 katun, or in reverse order 1-1-18-15. The numbers are distinct and of the ordinary type, and are given correctly, as is shown by inspection both of the photograph and drawing. That there is an error here (18 chuens being full count) seems apparent, unless the number at the left side of the chuen symbol refers to chuens and that above to days, which can not be accepted

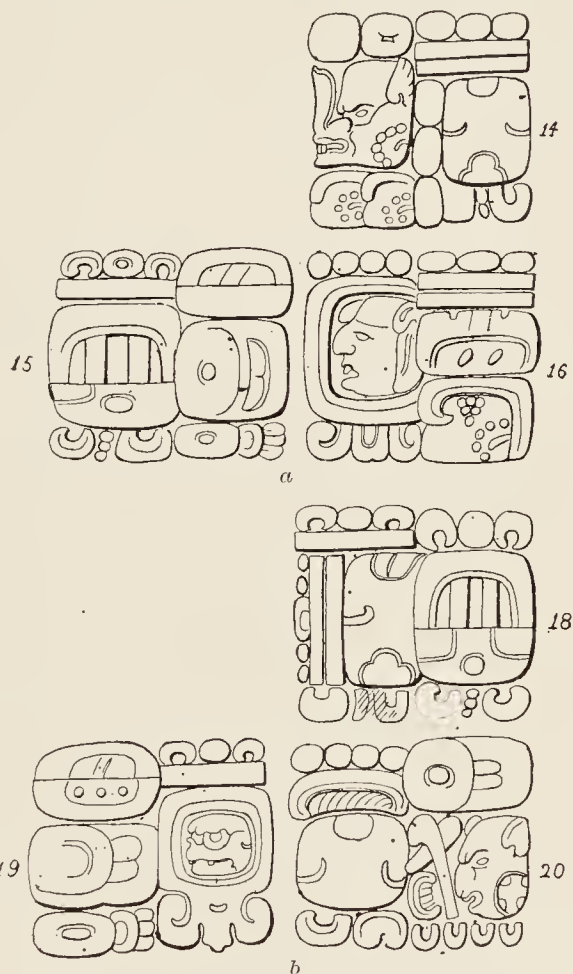


FIG. 154. Part of inscription on the west side of Stela E, Quirigua. Maudslay, part 12, plate xxxi.

without proof. Goodman reads "1-1-16-15," but the number over the symbol is 18 and not 16. The two outer of the three units are certainly balls, and not rings or semicircles. This series is followed at glyphs 23 and 24 (figure 155) by the date 11 Imix 19 Muan, and whether we count 18 or 16 chuens or consider the 15 as chuens and the 18 as days, it fails to connect the preceding with the following date. Before attempting to find the solution of the difficulty we will pass on to the next series and date and count back.

Passing on to glyphs 27 and 28 (figure 156) we find the series 8-19-4, followed (glyph 29) by the date 13 Ahau 18 Cumhu, and this is followed immediately (glyph 30) by the symbol for 17 katuns, apparently inserted, as it is followed by no date, to show that the date just preceding it is in the 17th katun, or that 17 katuns have been passed over from the commencement of the cycle, most likely the latter.



FIG. 155. Part of inscription on the west side of Stela E, Quirigua. Maudslay, part 12, plate XXXI.

As Goodman does not discuss this series, although he mentions it, I give my own explanation. That there is an error here, if the number over the chuén symbol is intended to indicate chuens, as there are but 18 chuens in an ahau, is apparent. Let us try the count with the day and chuén numbers reversed—that is, on the supposition that the series should read 8-4-19. This equals 2,979 days, which number counted

backward from 13 Ahau 18 Cumhu brings us to 11 Imix 19 Muan, which apparently justifies the change and proves the date "11 Imix 19 Muan" to be correct.

Turning to Goodman's "Archaic Chronological Calendar," to the 9th cycle of his 54th great cycle, in which the series of this inscription are located, we find that 13 Ahau 18 Cumhu is the first day of the 17th katun according to his method of numbering. However, it must be remembered that he begins the count of katuns with 20, following with 1, 2, etc., up to 19; therefore 13 Ahau 18 Cumhu is really the first day of the 18th katun, 17 entire katuns having been passed over from the initial date of the inscription (8 Ahau 13 Ceh, the first day of the 9th cycle). This verifies our conclusion as to the signification of the symbol for 17 katuns in glyph 30.

For the purpose of determining the third minor series given in the inscription as 1-1-18-15, followed by 11 Imix 19 Muan, we will count from the initial date of the inscription, plaeing side by side the series as given in the inscription and as corrected.

	As given	As corrected
Initial	9-14-12-4-17	9-14-13-4-17
Second	6-13-3	6-13-3
Third	1-6-14	6-14-6
Fourth	1-1-18-15	
Fifth	8-19-4	8-4-19
	9-16-11-6-13	9-15-15-1-5

If we subtract 9-15-15-1-5, the sum of the right column (omitting the 4th series), from 9-17-0-0-0, or, omitting the cycles, 15-15-1-5 from 17-0-0-0 (17 katuns), the remainder is 1-4-16-15, or 1 katun 4



FIG. 156. Part of inscription on the west side of Stela E, Quirigua. Maudslay, part 12, plate XXXI.

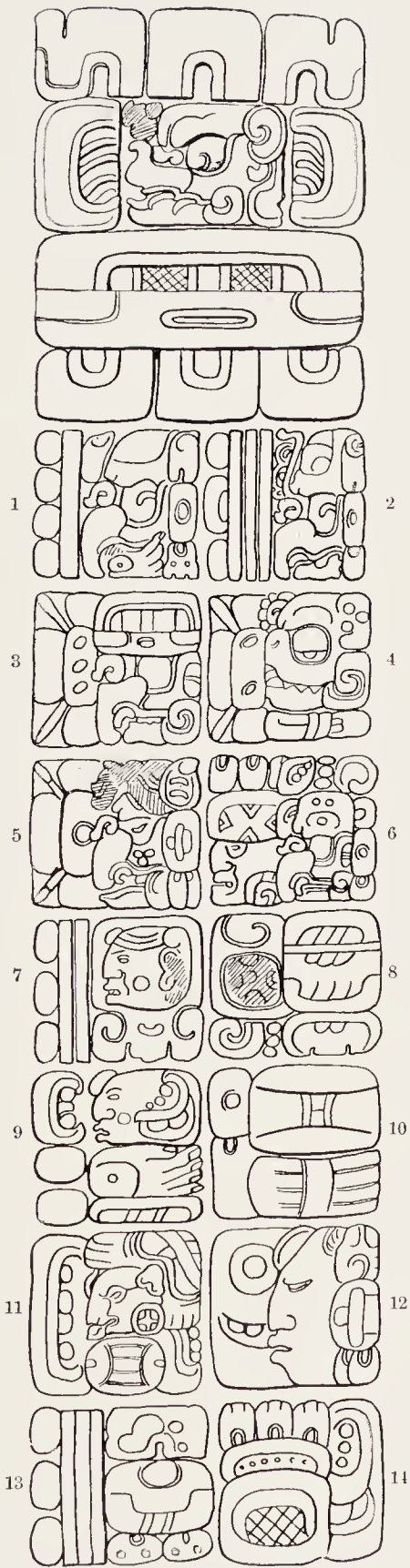
ahaus 16 ehuens and 15 days. This, if the preeeding corrections are justified, should be the 4th series, and should eonnect (eounting forward) the dates 6 Cimi 4 Tzec and 11 Imix 19 Muan, and calculation shows that it does. The 4th series should therefore be 1-4-16-15, or 8,975 days.

It will be seen from our examination of this inscription that some correction has been made in the 1st, 3rd, and 4th series, and that the day and chuen numbers have been reversed in the 5th. It must be admitted that this does not present a very favorable showing for the theory, yet I am convinced that the corrections in this instance are

justified; but a single variation is possible (that of the 3rd date) which would involve greater changes than those which have been made. That the number at the left of the chuen symbol sometimes denotes chuens and the one over the top sometimes denotes days is mentioned by Maudslay, yet it is very unusual and is probably due to carelessness. There is evidence of carelessness in this inscription in the writing of 18 and 19 chuens, and in giving 12 ahaus in the initial series instead of 13, as it evidently should be.

The next inscription referred to is that on the east side of Stela E, the drawing of which is shown in Maudslay's plate XXXII, part 12 (our plate LXXVIII). The initial series is 54-9-17-0-0-0, 13 Ahau 18 Cumhu. Goodman does not mention this inscription. It ends precisely where the preceding inscription ended. Although there are distinct dates scattered through it, and what appear to be partial series, I am unable to determine the latter from the unusual symbols of which they are formed, if they are present. The inscription appears to end, so far as dates are concerned, with 13 Ahau 18 Cumhu, the same as the terminal date of the initial series, which does not occur again in Goodman's tables until the beginning of the 9th ahau 4th katun 12th cycle is reached. This gives a lapse of 2-7-9-0-0 from the terminal date of the initial series. As nothing further in regard to the series can be learned from this inscription, we turn to that on Stela A, Maudslay's plate VII, part 11.

The initial series on Stela A is, as has been shown, 54-9-17-5-0-0, 6 Ahau 13 Kayab. Immediately following the month symbol of the date (glyph 16) is the symbol for 6 Ahau. This, I believe, is to show that the preceding date is the beginning of the 6th ahau, and so it is if we count the ahaus 1, 2, 3, etc., from the commencement of the katun, instead of 20, 1, 2, 3, etc., as Goodman counts them. It is my belief that the numbers expressed in the series denote, at least as a general rule, completed periods and not incomplete ones. Take, for example, the numbers in the initial series in this inscription, omitting the great cycle—9-17-5-0-0, that is, 9 cycles, 17 katuns, 5 ahaus, 0 chuens, 0 days. This may be read just as I have given it here, or as follows: The 5th ahau of the 17th katun of the 9th cycle. If it should be read as I have given it, it shows that Goodman's method of counting—beginning that of the cycles with 13 following with 1, 2, 3, etc., that of the katuns and ahaus with 20, and following with 1, 2, 3, etc.—is erroneous. If we read 9 cycles, 17 katuns, and 5 ahaus, the meaning is that 9 full cycles, plus 17 katuns, plus 5 ahaus must be counted to make the sum of the days between the preceding and following date, and this is in fact the method Goodman uses, and which must be used in making the calculation. On the other hand, according to his system, the series 9-17-5-0-0 would indicate that the date sought is the 1st day of the 5th ahau of the 17th katun of the



INSCRIPTION ON THE EAST SIDE OF STELA E, QUIRIGUA
MAUDSLAY, PART 12, PLATE XXXII

9th cycle, but the symbol 6 Ahau (glyph 16) denotes, if we have correctly interpreted it, that 6 Ahau 13 Kayab is the first day of the 6th ahau; nevertheless, Goodman's method of counting gives the correct result. Attention will again be called to the subject further on.

Returning to our inscription, we find in the 20th glyph the brief series 19 ahaus followed by the date 6 Ahau 13 Chen or 13 Zac, but the series does not connect the dates. There are no other recognizable series in the inscription.

The inscription on the west side of Stela C—the drawing of which is shown in Maudslay's plate 19, part 11 (our figure 147)—has, as heretofore stated, the initial series 54-9-1-0-0-0, 6 Ahau 13 Yaxkin. Following this date, at glyphs 16 and 17, is the numeral series 17-5-0-0, that is, 17 katuns, 5 ahaus, 0 chuens, 0 days, though in the usual reverse order of days, chuens, ahaus, katuns. This is in turn followed by the date 6 Ahau 13 Kayab. If we count this series as 16 katuns and 5 ahaus, it will exactly express the lapse of time from 6 Ahau 13 Yaxkin, the preceding date, to 6 Ahau 13 Kayab, the date which follows. But turning to Goodman's "Archaic Chronological Calendar," 54th great cycle, we find that the latter date, according to his numbering, is the 5th ahau of the 17th katun of the 9th cycle. Shall we accept this as the proper reading, or shall we conclude that there is an error in the number of katuns? 6 Ahau 13 Yaxkin is the first day of the 1st katun of the 9th cycle, according to Goodman's method of counting (though the 2nd, in fact, if the count began with 1), and 6 Ahau 13 Kayab is the first day of the 5th ahau, as Goodman counts (6th in fact), of the 17th (18th) katun. Counting from one date to the other gives just 16 katuns 5 ahaus, as the following subtraction shows:

$$\begin{array}{r} 9-17-5-0-0 \\ 9-1-0-0-0 \\ \hline 16-5-0-0 \end{array}$$

It is proper to bear in mind that by Goodman's method of numbering, the number given always expresses the number completed; thus, as he begins with 13 in numbering the cycles, his 1st cycle is in reality the second, one cycle having been completed and the 2nd entered upon. I am therefore disposed to correct 17 katuns in the series just examined to 16.

As these are the only series of the Quirigua inscriptions to which it is desirable to call attention at present, the next subject of examination is the great-cycle symbols, but in order to enter upon this intelligently it is necessary to discuss some points of Goodman's system not fully examined in my previous paper. In doing this it will be necessary to go to the very base of his system.

MAYA CHRONOLOGICAL SYSTEM

The theory that Goodman has adopted, so far as it relates to the scale of units or time periods, as he terms them, may be expressed in the following series, the day being the primary unit:

Day	1 day
20 days make 1 chuen	20 days
18 chuens make 1 ahau	360 days
20 ahaus make 1 katun	7,200 days
20 katuns make 1 cycle	144,000 days
13 cycles make 1 great cycle	1,872,000 days
73 great cycles make 1 grand era	136,656,000 days

This scheme is, as was explained in my previous paper, precisely the same as that generally accepted, so far as the numbers are concerned, until, in ascending the scale, the number of cycles, or units of the 5th order, forming a great cycle, or unit of the next higher order, is reached. At this point Goodman abandons the vigesimal system and introduces in one step 13 and in the other 73 as multipliers—numbers which are absolutely necessary to his theory; for if either be dropped, his theory falls with it. If these supposed time periods are, as I contend, nothing more than orders of units in the system of numeration, then we must assume that the vigesimal system was followed. To this point attention is directed, and although it is discussed somewhat at length in my previous paper, there is other evidence bearing on the question, which will be introduced here. It was shown there that one series in the Dresden codex recognizes 20 cycles to the great cycle (I shall continue to use these terms merely for convenience, to indicate the orders of units). A more careful study of that codex shows that there are other series which also furnish conclusive evidence on this point.

The theory, therefore, which I shall attempt to show is the correct one is that in both the Dresden codex and the inscriptions the vigesimal system was maintained throughout, except only in the second step; not only that 20 ahaus make 1 katun and 20 katuns make 1 cycle, but also that 20 cycles make 1 great cycle and 20 great cycles 1 next higher step, should the count extend so far.

Before we consider the examples which are to be introduced as evidence in support of this theory, it will be best, in order to see more clearly the bearing and the force of this evidence on the question, to present an explanation of the order of succession of the great cycles when the vigesimal system is followed, that is, when 20 cycles are counted to the great cycle.

As the day Ahau is found to be the first day of several, in fact most, of the initial series of the inscriptions, and is that adopted by Goodman as the beginning of his grand era, as also of his great cycles, I, for the present, assume it as the initial day of the latter periods.

According to his scheme of counting 13 cycles to each of these

periods, they all begin with the day 4 Ahau. If the first day of the ahaus is Ahau, then it is certain that the first day of each of the higher periods will be Ahau, though we count 13 or 20 cycles to the great cycle. As the days of the calendar are numbered 1, 2, 3, etc., up to 13, the count then beginning again with 1, and this numbering is continued in regular order, and as Ahau will return only every 20th day it is apparent that it will receive different numbers. If the days are written out in regular succession and the series is made of sufficient length, it will be found, if we select a 13 Ahau and begin our count with it and count 360 days (1 ahau) to each step, that the numbers attached to the days (which will of course be Ahaus) will come (the count being forward) in the following order: 13, 9, 5, 1, 10, 6, 2, 11, 7, 3, 12, 8, 4, 13, 9, 5, etc., this order being maintained wherever in the series we may begin.

As it takes 20 ahaus or units of the 3rd order to make one of the 4th, it follows that if the day numbers are written out in succession in the order above stated, the first days of the katuns will be those of the 20th ahaus, their numbers will therefore come in the following order: 11, 9, 7, 5, 3, 1, 12, 10, 8, 6, 4, 2, 13, 11, 9, 7, etc., the order remaining the same regardless of the point at which the count begins. As 20 katuns make 1 cycle, the numbers of the first days of the cycles will be the same as those of the 20th katuns, and will be as follows: 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 13, 12, etc. The beginning point in these series is arbitrary.

It may also be shown by simple calculation that the order of the day numbers of the first days of the higher periods or orders of units will be as given above. As the numbers of the first days of the ahaus vary successively by 4, if we multiply 4 by 20 (20 ahaus being required to make a katun) and divide by 13, the remainder is 2; hence, if the first day of a given katun is 9, the first day of the one which follows will be 7 Ahau, the difference being subtracted if counting forward, and added if counting backward. When the number of the day is less than 3 we add 13, and then subtract in counting forward, and in counting backward subtract 13 when the sum is greater than this number. As it takes 400 ahaus to make 1 cycle, we multiply the difference, 4, by this number, and divide the product by 13. This leaves a remainder of 1, hence we subtract 1 from the number of the first day of a given cycle to find the first of that which follows, or add 1 to find the first of that which precedes.

As, according to Goodman's theory, 13 cycles make a great cycle, then it requires $20 \times 20 \times 13$ ahaus to make 1 great cycle. We multiply 4 by $20 \times 20 \times 13$ (or 5,200) and divide by 13. This leaves no remainder, and hence, according to this scheme, the day numbers of the first day of all the great cycles will be the same, and so Goodman gives them in his "Perpetual Chronological Calendar." Here the question of number arises. Is it 1 Ahau, 2 Ahau, or 3 Ahau, etc., to

13 Ahau? Goodman says 4 Ahau. He bases this, doubtless, on the fact that many of the initial series of the inscriptions have as their first day 4 Ahau 8 Cumhu, which he assumes, apparently correctly, is the first day of a great cycle. It is apparent, following his method of numbering, that if one great cycle begins with 4 Ahau, all the rest do.

As yet we have not introduced the year as a factor, but before this is done attention is called to the result of following the vigesimal system in counting the higher orders of units, or time periods, as Goodman considers them. According to this system, which, as I have stated, prevails in the Dresden codex, not only does it take 20 ahaus to make 1 katun and 20 katuns to make 1 cycle, but also 20 cycles to make 1 great cycle. The order in which the numbers of the initial days of the ahaus, katuns, and cycles follow one another will be the same in the one scheme as in the other and as already given. The difference between the two theories appears in the numbers of the initial days of the great cycles. Following the method of calculation indicated, we multiply 4 by $20 \times 20 \times 20$ (or 8,000) and divide by 13. This gives a remainder of 7. The order of the numbers is therefore 13, 6, 12, 5, 11, 4, 10, 3, 9, 2, 8, 1, 7, 13, 6, 12, etc., and this is found to be correct by the absolute test of writing out the numbers of the first days of the cycles in proper order and taking every 20th one. The initial dates of a sufficient number to cover all probable requirements are given here, 4 Ahau 8 Cumhu being adopted as the basis or check point from which to count forward and backward. In this calculation we must bring into the problem the year factor.

Initial days of the great cycles, following the vigesimal system

1.....	5 Ahau 8 Muan,	year 4 Ben
2.....	11 Ahau 13 Zotz,	year 4 Lamat
3.....	4 Ahau 3 Ceh,	year 3 Ezanab
4.....	10 Ahau 8 Pop,	year 3 Ben
5.....	3 Ahau 18 Mol,	year 2 Akbal
6.....	9 Ahau 8 Pax,	year 1 Ben
7.....	2 Ahau 13 Tzec,	year 1 Lamat
8.....	8 Ahau 3 Mac,	year 13 Ezanab
9.....	1 Ahau 8 Uo,	year 13 Ben
10.....	7 Ahau 18 Chen,	year 12 Akbal
11.....	13 Ahau 8 Kayab,	year 11 Ben
12.....	6 Ahau 13 Xul,	year 11 Lamat
13.....	12 Ahau 3 Kankin,	year 10 Ezanab
14.....	5 Ahau 8 Zip,	year 10 Ben
15.....	11 Ahau 18 Yax,	year 9 Akbal
16.....	4 Ahau 8 Cumhu,	year 8 Ben
17.....	10 Ahau 13 Yaxkin,	year 8 Lamat
18.....	3 Ahau 3 Muan,	year 7 Ezanab
19.....	9 Ahau 8 Zotz,	year 7 Ben
20.....	2 Ahau 18 Zac,	year 6 Akbal

As no larger number of great cycles has been recorded than 14, in one of the Copan inscriptions, 6 being the highest given in the Dres-

den codex, the initial dates given will probably suffice for all requirements. But this supposition rests on the theory that the range counting by great cycles, is not more than 14 from 4 Ahau 8 Cumhu. Our numbering (left column) is, of course, purely arbitrary, given merely for convenience of reference, the great cycles being, on the theory I have presented, in precisely the same relation to the next higher order of units—provided the Mayan count extended so far—as the cycles to the great cycles, the katuns to the cycles, etc. In other words, when, in counting, 20 cycles are completed, one great cycle is completed and the count passes into the 2nd; and when this is completed we pass into the 3rd, etc., in precisely the same manner that we pass in our decimal system from one decimal to the next higher.

Our next step is to test the theory advanced by appeal to the high series which reach to the great cycles, beginning with those of the Dresden codex. These are found on plates LXI, LXII, and LXIX. As the determination of the point in question is of vital importance, the details of the demonstration will be given somewhat fully.

Taking first plate LXII of the codex (our plate LXXIX), we observe four numeral series running upward in the folds of two serpent figures, two of these series being in black numerals of the ordinary form, and two in red, also of the ordinary form. The two series in the left serpent (one black and the other red) are as follows reading from the top down:

Red	4-6-11-10-7- 2, 3 Cimi 14 Kayab
Black	4-6- 7-12-4-10, 3 Ix 7 Pax (?)

That is to say, the red series is 4 great cycles, 6 cycles, 11 katuns, 10 ahaus, 7 chuens, 2 days, to 3 Cimi 14 Kayab. The symbols of the dates as we give them are seemingly reversed as compared with their positions on the plate, but the zigzag order of the series must be borne in mind. The symbol of the month Pax is somewhat unusual.

The red series changed into days is as follows:

	Days
4 great cycles (of 20 cycles each)	11,520,000
6 cycles.....	864,000
11 katuns.....	79,200
10 ahaus	3,600
7 chuens.....	140
2 days	2
Total amount.....	12,466,942
Subtract 655 calendar rounds.....	12,450,880
Remainder	16,062

Using this remainder and counting forward from 9 Kan 12 Kayab (year 3 Ben)—the date standing over the head of the figure seated on the serpent—we reach 3 Cimi 14 Kayab, year 8 Ben, the date standing below.

We have positive evidence, therefore, that in this instance 9 Kan

12 Kayab is the initial day of a great cycle and that 20 cycles are counted to the great cycle, since the number 11,520,000 is obtained as follows:

1 cycle	144,000 days
Multiplied by	20
1 great cycle	2,880,000 days
Multiplied by	4
4 great cycles	11,520,000 days

If we follow Goodman's method and count only 13 cycles to each great cycle, 4 of the latter, together with the minor periods of the series as given above, will amount to 8,432,942 days. Subtract 444 calendar rounds, and there remain 5,822 days, which, counted from 9 Kan 12 Kayab, bring us to 7 Cimi 14 Pax. This is not correct as to the number of the day or as to the month. The same day should be reached, for the number of cycles is the only thing in the series changed.

We take next the black series of the same pair, to wit, 4-6-7-12-4-10, 3 Ix 7 Pax. This changed into days is as follows:

	Days
4 great cycles (of 20 cycles each)	11,520,000
6 cycles	864,000
7 katuns	50,400
12 alaus	4,320
4 chuens	80
10 days	10
Total	12,438,810
Subtract 655 calendar rounds	12,431,900
Remainder	6,910

Using this remainder and counting forward from 9 Kan 12 Kayab, year 3 Ben, the same initial date as before used, we reach 3 Ix 7 Pax, year 9 Lamat. This is correct.

The series in the folds of the right serpent (same plate as the preceding) are as follows:

Black	4-6-9-15-12-19, 13 Akbal 1 Kankin
Red	4-6-1- 9-15- 0, 3 Kan 16 (?) Uo

Changing the red series into days, we have the following result:

	Days
4 great cycles (of 20 cycles each)	11,520,000
6 cycles	864,000
1 katun	7,200
9 alaus	3,240
15 chuens	300
Total	12,394,740
Subtract 653 calendar rounds	12,393,940
Remainder	800



PLATE LXII OF THE DRESDEN CODEX

Using this remainder and counting forward from 9 Kan 12 Kayab (same initial date as before), we reach 3 Kan 17 Uo, year 6 Lamat. This is correct, as it gives the date below, except as to the day of the month—which is given as 16 Uo in the original, but should be 17 Uo, as Kan is never the 16th day of the month. What is meant by the calendar rounds and the reason for subtracting them was fully explained above and in my previous paper.

The black series of the same pair changed into days gives the following numbers:

	Days
4 great cycles (of 20 cycles each)	11,520,000
6 cycles	864,000
9 katuns	64,800
15 ahaus	5,400
12 chuens	240
19 days	19
Total	12,454,459
Subtract 656 calendar rounds	12,450,880
Remainder	3,579

Counting forward this number of days from 9 Kan 12 Kayab, year 3 Ben, we reach 13 Akbal 1 Kankin, year 13 Akbal. This also is correct.

The next series noticed is the one consisting of black numerals in the folds of the serpent on plate LXIX of the Dresden codex (our plate LXXX). This is as follows: 4-5-19-13-12-8, 4 Eb ? (month); the month symbol is obliterated. As the black and red are not zigzagged in this instance, the date belonging to the black series stands immediately under it. Changed into days, the series gives the following result:

	Days
4 great cycles (of 20 cycles each)	11,520,000
5 cycles	720,000
19 katuns	136,800
13 ahaus	4,680
12 chuens	240
8 days	8
Total	12,381,728
Subtract 652 calendar rounds	12,374,960
Remainder	6,768

In this instance, as on plate LXII of the codex, the date 9 Kan 12 Kayab stands above the serpent. Counting forward 6,768 days from this date, we are brought to 4 Eb 5 Chen, year 9 Lamat, which agrees with the unobliterated part of the date given below.

We have, therefore, in the data presented positive proof that in five instances in the Dresden codex the day 9 Kan 12 Kayab is the first day of a great cycle, and that twenty cycles are counted to one

great cycle. In these instances 9 Kan 12 Kayab is the initial day of the first or more remote of the four great cycles counted in the series which have been noticed. The four here, however, has no reference to the numbers applied to the high periods, if, in fact, any were applied, but is merely the number of one of the orders of units used in counting, just as we say "4 thousands, 5 millions," etc. However, the idea intended to be set forth here will be more fully explained farther on.

In order to show that 9 Kan, as used in the series examined, is the initial day of the most remote of the four great cycles of these series, the following proof is presented.

If we arrange the last-mentioned series perpendicularly in ascending order, as in the original, except that we separate the great cycles, it will stand as follows:

4th great cycle (completed)
 3rd great cycle (completed)
 2nd great cycle (completed)
 1st great cycle (completed)
 5 cycles
 19 katuns
 13 ahaus
 12 chuens
 8 days

The reader must keep in mind all the way through that, although Goodman's terms are used, they are to be understood as representing merely orders of units. Hence, 4th great cycle, 3rd great cycle, etc., are intended to convey the same idea that is conveyed by "4th million, 3rd million," etc. These terms are used merely as convenient designations in numeration. Each and every series in the inscriptions and codices signifies nothing more nor less than so many days, the day being the unit.

Our separation of the great cycles is therefore nothing more than separating the millions and lower denominations in the expression "4,234,600," just as has been done above. The object of this separation is to ascertain the beginning day of each of these numbers which Goodman calls time periods, as this forms a check on our calculations. For example, if I assert that 4,000 days from Thursday, January 1, 1889, will reach Saturday, December 18, 1899, by counting 1,000 days we reach a certain date, and 1,000 more a certain other date, etc. If the fourth 1,000 brings us to the same date as counting at once 4,000, we thereby check the one calculation by the other. The separation is to be understood as signifying nothing more than this, and not as implying real time periods of a chronological system.

If we can ascertain the first day of the first of these great cycles, and count forward from the date so obtained, one by one, 4 great



PLATE LXIX OF THE DRESDEN CODEX

cycles, 5 cycles, 19 katuns, 13 ahaus, 12 chuens, and 8 days, we should, if my theory be true, reach the same date (4 Eb 5 Chen, year 9 Lamat) as by counting the whole series, thus obtaining a check on our calculation.

	Days
Multiply 1 cycle	144,000
by 20	20
1 great cycle of 20 cycles	2,880,000
Subtract 151 calendar rounds	2,865,980
Remainder	14,020

Counting forward this number of days from 9 Kan 12 Kayab, year 3 Ben, we reach 2 Kan 17 Xul, year 3 Lamat. This should be the initial day of the 3rd great cycle, as numbered above. Counting forward 14,020 days from 2 Kan 17 Xul, year 3 Lamat, brings us to 8 Kan 7 Kankin, year 2 Ezanab. This should be the first day of the 2nd great cycle, as numbered above. Counting forward 14,020 days from the latter date (8 Kan 7 Kankin, year 2 Ezanab), we reach 1 Kan 2 Zip, year 2 Ben. This should be the first day of the 1st great cycle, as numbered above, and with the subordinate periods gives the series 1-5-19-13-12-8, or 1 great cycle, 5 cycles, 19 katuns, 13 ahaus, 12 chuens, 8 days. Counting forward from 1 Kan 12 Zip, year 2 Ben, should bring us to 4 Eb 5 Chen, year 9 Lamat, the date obtained by counting the entire series from 9 Kan 12 Kayab, year 3 Ben.

In order to test it we make the calculation; reduced to days, the result is as follows:

	Days
1 great cycle (of 20 cycles)	2,880,000
5 cycles	720,000
19 katuns	136,800
13 ahaus	4,680
12 chuens	240
8 days	8
Total	3,741,728
Subtract 197 calendar rounds	3,739,060
Remainder	2,668

Counting forward this number of days from 1 Kan 12 Zip, year 2 Ben, we reach 4 Eb 5 Chen, year 9 Lamat, the date at the bottom of the series, and the same as that obtained by using the entire series and counting from 9 Kan 12 Kayab.

As a further test, we count forward 14,020 days from 1 Kan 12 Zip, year 2 Ben, and reach 7 Kan 2 Zac, year 1 Akbal. This should be the first day of the incomplete great cycle in which the minor periods fall. Therefore, by taking the sum of these periods and counting forward from this date, we should reach 4 Eb 5 Chen, year 9 Lamat.

Reducing these periods (5 cycles, 19 katuns, 13 ahaus, 12 chuens, 8 days) to days, we get the following result:

	Days
5 cycles.....	720,000
19 katuns.....	136,800
13 ahaus.....	4,680
12 chuens.....	240
8 days.....	8
Total.....	861,728
Subtracting 45 calendar rounds.....	854,100
Remainder.....	7,628

Counting forward 7,628 days from 7 Kan 2 Zac, year 1 Akbal, we reach 4 Eb 5 Chen, year 9 Lamat, which is the proper date.

The demonstration therefore seems to be complete that Kan, in the cases referred to, is the first day of each of the great cycles. It is also important to notice that the numbers of these Kans follow one another in precisely the same order as do those of the Ahaus when 20 cycles are counted to the great cycle (see page 236) to wit: 9, 2, 8, 1, 7, and, if the series is continued by calculation, 13, 6, 12, 5, 11, 4, 10, 3, 9, 2, etc.

If we arrange these first days of the great cycles in the order in which they come, adding the days of the month on which they fall, they will be as follows—the numbering (column at the left) being, of course, purely arbitrary:

1.....	2 Kan 17 Cumhu, year 10 Lamat
2.....	8 Kan 2 Mol, year 10 Akbal
3.....	1 Kan 12 Muan, year 9 Ben
4.....	7 Kan 17 Zotz year 9 Lamat
5.....	13 Kan 7 Ceh, year 8 Ezanab
6.....	6 Kan 12 Pop, year 8 Ben
7.....	12 Kan 2 Chen, year 7 Akbal
8.....	5 Kan 12 Pax, year 6 Ben
9.....	11 Kan 17 Tzec, year 6 Lamat
10.....	4 Kan 7 Mac, year 5 Ezanab
11.....	10 Kan 12 Uo, year 5 Ben
12.....	3 Kan 2 Yax, year 4 Akbal
13.....	9 Kan 12 Kayab, year 3 Ben
14.....	2 Kan 17 Xul, year 3 Lamat
15.....	8 Kan 7 Kankin, year 2 Ezanab
16.....	1 Kan 12 Zip, year 2 Ben
17.....	7 Kan 2 Zac, year 1 Akbal
18.....	13 Kan 12 Cumhu, year 13 Ben
19.....	6 Kan 17 Yaxkin, year 13 Lamat
20.....	12 Kan 7 Muan, year 12 Ezanab

This is calculated from 9 Kan 12 Kayab as a basis, because we have found it to be such for some of the series of the Dresden codex.

In order to add proof to our explanation and calculation of the series in the serpent figures of plate LXII of the codex, I show the result

of calculating the differences between the series and passing from one of the final dates to the other. I had tried this before, but, not allowing for the zigzag course of the series, I failed to get the dates at the bottom in right relation to the series.

Take first the series in the right-hand serpent, as follows:

Black	-----	4-6-9-15-12-19, 13 Akbal 1 Kankin
Red	-----	4-6-1- 9-15- 0, 3 Kan 16 (17) Uo
Difference	-----	8-5-15-19

This difference, counted forward from 3 Kan 17 Uo (the 16 being an error), should reach 13 Akbal 1 Kankin.

Reducing to days, we have the following result:

	Days
8 katuns	----- 57,600
5 ahaus	----- 1,800
15 chuens	----- 300
19 days	----- 19
Total	----- 59,719
Subtract 3 calendar rounds	----- 56,940
Remainder	----- 2,779

Using this remainder and counting forward from 3 Kan 17 Uo, year 6 Lamat, we reach 13 Akbal 1 Kankin, year 13 Akbal. This is correct, and proves that we should read 17 Uo instead of 16.

The two series in the other (left-hand) serpent are as follows:

Red	-----	4-6-11-10-7- 2, 3 Cimi 14 Kayab
Black	-----	4-6- 7-12-4-10, 3 Ix 7 Pax
Remainder	-----	3-18-2-12

This remainder, counted forward from 3 Ix 7 Pax, which is the date belonging to the black series, will bring us to 3 Cimi 14 Kayab, which is the date belonging to the red series.

The relation between the pairs of the two serpents is between the like colors. For example, by using the difference between the red series of the right serpent and that of the left, and counting forward from 3 Kan 17 Uo, we reach 3 Cimi 14 Kayab. By using the difference between the black series, and counting forward from 3 Ix 7 Pax, we reach 13 Akbal 1 Kankin. These results serve to confirm the results of the calculations when the entire series is taken into the count.

There are five other high series in the Dresden codex, to which I have not as yet alluded—four in the serpent figures on plate LXI, and the red series in the serpent on plate LXIX. The reason for passing over them temporarily is that some of them require correction, and others present difficulties to successful calculation and satisfactory interpretation which I have not as yet been able to overcome. As the object in view is to discover the truth and not merely to support a

theory, it is proper that these difficulties should be explained to the reader that he may judge whether they have any bearing on the question under discussion.

The first of these series to which reference will be made are the black and red in the left serpent on plate LXI of the codex (our plate LXXXI). These, as they stand on the plate, are as follows:

Black ----- 4-6-14-13-15-1, 3 Chicchan 13 Pax
Red ----- 4-6- 0-11- 3-2, 3 Chicchan 18 Xul

In this instance, as on plate LXII, the dates under the series are here seemingly reversed by the zigzag arrangement of the series—a fact which is to be borne in mind; therefore, that which is apparently under the black belongs to the red. The last (lowest) number of the red series denoting days is obliterated, but calculation soon makes it apparent that it was 1. The initial date here is the same as that of the other series of this codex heretofore referred to, to wit, 9 Kan 12 Kayab, which stands in the text above the serpent.

Calculating the series as they stand in the original, counting from the initial date (9 Kan 12 Kayab), we find, whether we assume 20 or 13 cycles to the great cycle, that neither of the dates standing below will be reached. The proper day, and even the day of the month, may be reached, but not the full date as given. Counting 20 cycles to the great cycle, we are brought by the black series to 1 Chicchan 18 Chen, year 6 Lamat; the red series (adding one day) brings us to 5 Chicchan 13 Mac, year 13 Ben. The result in both cases is wrong. Counting 13 cycles to the great cycle in the black, we reach 3 Chicchan 13 Kayab, year 9 Ben; and the red series brings us to 7 Chicchan 3 Zip, year 4 Akbal. Both results are wrong, though the first is apparently within one month of being correct—the day, day number, and day of the month being right. However, the two dates are in reality 32 years apart. We might assume the number of months (chueus) to be 14, instead of 15 as given in the original, if this would bring both series in harmony; or we might change the month from Pax to Kayab, if this would meet the difficulty throughout. The two series, black and red, are evidently related, and the difference between them must connect the dates reached by counting each series from the initial date (9 Kan 12 Kayab). The difference in this case, 13 cycles being counted to the great cycle, brings the red series to 7 Chicchan 3 Zip, year 4 Akbal, which is wrong.

With seeming inconsistency, I propose a correction more radical than either of those suggested above. I believe the aboriginal artist by inadvertency made an exchange between the black and red series in the ahans and chueus, and that, instead of being as given above, they should be as follows:

Black --- 4-6-14-11- 3-1, 3 Chicchan 13 Pax
Red --- 4-6- 0-13-15-1, 3 Chicchan 18 Xul

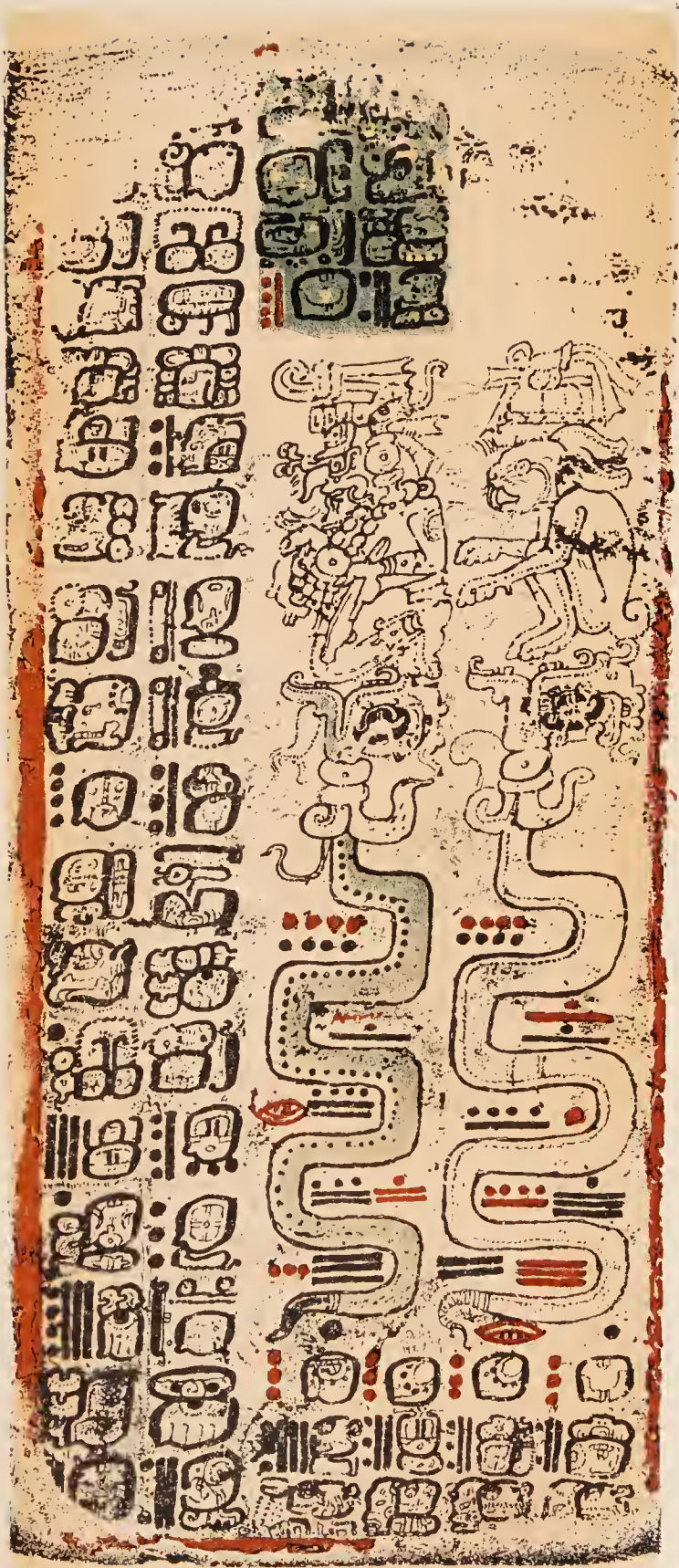


PLATE LXI OF THE DRESDEN CODEX

The series evidently requires that the days of the terminal dates shall each be 3 Chicchan.

Counting forward from 9 Kan 12 Kayab, year 3 Ben, the amount of the black series (equaling 12,488,821 days), we reach 3 Chicchan 13 Pax, year 3 Ben; and counting from the same initial date the red series (equaling 12,388,981 days), we reach 3 Chicchan 18 Xul, year 3 Lamat. Both results are correct, and counting from 3 Chicchan 18 Xul, year 3 Lamat, the difference between the two series as thus corrected (equaling 99,840 days), we reach 3 Chicchan 13 Pax, year 3 Ben, the terminal date of the black series.

Neither of the series in the right-hand serpent of this plate brings the count to either of the dates which stand below them. As yet I am unable to find in what the error consists. As the text above this right-hand serpent has been obliterated, it is possible, though I do not think probable, that a different initial date is given. As both series counted backward reach a 9 Kan, but of different months, I am inclined to believe that the error consists in one or both month symbols of the terminal dates.

The other series which has not been considered is the red one in the serpent on plate LXIX, Dresden codex. The difficulty in this case arises from the insufficient data, the number in the katun place having been omitted or obliterated, and the month symbol of the terminal date being too nearly obliterated for anything positive in regard to it to be determined. If the month symbol could be determined by inspection, the data would be sufficient to give the number of katuns correctly; but with the series in its imperfect condition, we can only state that, by a trial substitution of the numbers from 1 to 19 in the katun place, we find that this number must be either 1 or 14. If it be 1, the terminal date is 9 Ix 12 Zip; if it be 14, the terminal date is 9 Ix 12 Zac. As the fragment of the month symbol, small as it is, apparently forbids the supposition that it is Zac, it is probably Zip.

Taking the difference between the red series, as thus corrected, and the black series, and counting back from 9 Ix 12 Zip, we reach 4 Eb 5 Chen, year 9 Lamat, which agrees with the result of counting the black series from the initial date. The solution, therefore, appears to be satisfactory.

As Dr Seler raises another question in regard to these high series of the Dresden codex, we will consider it before passing on. It will be noticed that in the text (double column) at the left of the serpents on plates LXI and LXIX, there is, in each case, a numeral series given in symbols in the same form as those in the inscriptions. The one on plate LXI is 15-9-1-3, or 15 katuns, 9 ahaus, 1 chuen, 3 days; that on plate LXIX is 15-9-4-4, or 15 katuns, 9 ahaus, 4 chuens, 4 days. The date following in each case is 9 Kan 12 Kayab, and the date preceding is in each case is 4 Ahau 8 Cumhu. Now, Dr Seler, if I

rightly understand him, contends that this series belongs to, or is connected with, the series in the serpent figures, and is to show that the count is carried back to 4 Ahau 8 Cumhu as the initial date, though he has failed to make connection between the dates by the series in the text.

As the initial and terminal dates (4 Ahau 8 Cumhu and 9 Kan 12 Kayab) are the same on both plates, and the number of the katuns and ahaus the same in both, it is certain there is a mistake in one or the other in regard to the number of chuens and days—one being 4 chuens, 4 days, and the other 1 chuen, 3 days—as the terminal date can not occur twice in the lapse of time between one and the other, that is, in 61 days. However, neither series will connect the two dates. The series on plate LXIX when reduced to days is as follows:

	Days
15 katuns.....	108,000
9 ahaus.....	3,240
4 chuens.....	80
4 days.....	4
Total.....	111,324
Subtract 5 calendar rounds.....	94,900
Remainder.....	16,424

Counting this number of days forward from 4 Ahau 8 Cumhu, year 8 Ben, we reach 9 Kan 7 Cumhu, year 1 Ezanab—a date 37 years later than the proper one; nor will counting backward give the proper result. It is apparent from the problem itself that the numeral series must be materially changed in order to connect these dates, if this was the object of the aboriginal artist. That the two dates are too prominent for either to be changed will be admitted. As 4 Ahau 8 Cumhu falls in the year 8 Ben, and 9 Kan 12 Kayab in the year 3 Ben, the lapse of time from the former to the latter, counting forward (the necessary direction on Seler's assumption) is 2,904 days (plus any number of calendar rounds); while the number of days over and above the calendar rounds in one of the series (plate LXIX) is 16,424 days, and in the other (plate LXI) is 16,263 days. The difference between 16,263 and 2,904 is 13,459. Therefore, correcting the series, as the dates can not be changed, involves dropping out 13,459 days, or nearly 37 years. It is impossible to make this correction by any change in the number of chuens and days, and as the katuns and ahaus are the same on both plates, it is presumable that they are as they were intended to be. Therefore, while the positions of the dates in the text in relation to the numeral series would seem to indicate that they were intended to be connected by it, no justifiable correction or reasonable manipulation of the series appears to bear out this theory. It would seem from these facts that the data do not sustain Seler's assumption.

Suppose, however, that it was the intention of the aboriginal artist to connect the dates by these short series, and that each of them contains some error, and when corrected would make the connection, let us see what the result would be. The entire series on plate LXIX—taking that in the text as it stands, and the black one in the serpent figure, making 15-9-4-4 plus 4-5-19-13-12-8, 4 Eb ? (month)—would throw back the initial date 12,493,052 days, or a little over 34,226 years, previous to the terminal date 4 Eb of the series. This is wholly inconsistent with the idea expressed by Seler (quoted farther on) that the terminal dates of the inscriptions indicate, respectively, the time of the erection of the monument, and that these dates fall within or after the 10th cycle (Goodman’s 9th of the 54th great cycle). If the 4 Ahau 8 Cumhu of this series is the same 4 Ahau 8 Cumhu in actual time as the first of Goodman’s 54th great cycle—or, as Seler calls it, the “normal date”—then the series must run far into the actual future, or all the dates of the inscriptions must be far back in the past, and are merely theoretical. The only other supposition is that the 9 Kan 12 Kayab in the columns at the left is not identical with the 9 Kan 12 Kayab that stands above the serpent, and with which the series in the folds are undoubtedly connected.

As the final date in the series referred to in the preceding paragraph is incomplete, in lacking the day of the month, we will try the one on plate LXI. Using the black series in the folds of the left serpent, as this is the largest of the four great series on this plate and hence presumably the last (though the rule, if correct, should hold good with any of the series), we have 15-9-1-3 plus 4-6-14-13-15-1 (as they stand on the plate). Counting 20 cycles to the great cycle and changing to days, we arrive at the following result:

	Days
4 great cycles	11,520,000
6 cycles	864,000
14 katuns	100,800
13 ahaus	4,680
15 chuens	300
1 day	1
	<hr/>
	12,489,781
Add amount of short series	111,263
	<hr/>
Total	12,601,044
Subtract 663 calendar rounds	12,583,740
	<hr/>
Remainder	17,304

Using this remainder and counting forward from 4 Ahan 8 Cumhu, year 8 Ben, we reach 9 Imix 9 Mol, year 4 Ben. This is wrong. Let us use the series as corrected on a previous page, to wit: 4-6-14-11-3-1,

or 12,488,821 days. Adding the shorter series and counting forward from 4 Ahau 8 Cumhu, we reach the date 4 Kan 2 Yaxkin. This again is wrong. Using the larger series as corrected and counting from 9 Kan 12 Kayab we reach, as has already been shown, the correct date, 3 Chicchan 13 Pax. It is therefore fair to conclude that there are no sufficient grounds for Seler's supposition.

These erroneous conclusions arise chiefly from the mistaken idea that these numbers, ahaus, katuns, etc., are real time periods. Moreover, it does not necessarily follow, where such high numbers are used, that 4 Ahau 8 Cumhu is what Seler calls the "normal date"; that is to say, the initial day of Goodman's 54th great cycle. But this does not matter in the present case, as the date can not be connected with any of the others given in the series.

Even could the series be reasonably changed so as to make the connection between the given dates, we still have staring us in the face the fact that 9 Kan 12 Kayab is actually and beyond question used in the codex as the initial day of the so-called great cycle in six instances, and that a Kan is the initial date in 3 times 6 other instances. It is true that these so-called great cycles are but orders of units, steps in numeration, and not real time periods; nevertheless, they are just as real when counting from a Kan as from an Ahau.

In order that the reader may clearly understand the object in view in introducing these calculations, and see the bearing they have on the question, it is necessary again to refer to the basis of Goodman's theory of the Mayan time system, and especially of his supposed separate "chronological calendar."

Goodman maintains that in addition to their regular annual calendar in which time was counted by years, months, days, etc., the Mayas made use of another time system which he terms the "chronological calendar." In this system, according to his theory, they counted time by certain determinate periods, which, according to the nomenclature arbitrarily adopted by him, are termed chuens (each of 20 days); ahaus (each of 18 chuens or 360 days); katuns (each of 20 ahaus or 7,200 days); cycles (each of 20 katuns or 144,000 days); great cycles (each of 13 cycles or 1,872,000 days), and a grand era equal to 73 great cycles. These he believes to be real time periods, as truly so as the years, etc., of the annual calendar, systematically arranged and all above the chuens always (so far as time count in the inscriptions is concerned) beginning with a day Ahau, the great cycles always with the day 4 Ahau. It is in this supposition that Goodman's great error lies, and, in order to support his premise, he changes two of the steps of the Mayan numeral system without the slightest evidence on which to base the change, and he also introduces factors into the numeral system which are wholly unknown to it. If these statements which I make can be maintained by satisfactory evidence, then his theoretic "Archaic Chronological System" falls to

the ground, though his discoveries as to the signification of certain glyphs and the manner in which they were used be genuine, and his calculations of series be correct, and though his tables be also correct in the main.

The annual calendar system, which is that one long ago explained and accepted (that of months, years, etc.), is not in dispute. It is his theory of another time system, his so-called "Chronological Calendar," which I assert is without basis of fact. This calendar, which he says he "finally deduced," he expects will be challenged, but he "leaves it to defend itself, conscious that it is as infallible as the multiplication table."

Before referring to the proof bearing on this subject already presented, we shall call attention again to Goodman's method of numbering these periods. The chuens he says were numbered 18, 1, 2, 3, etc., up to 17; the ahaus and katuns were numbered 20, 1, 2, 3, etc., up to 19; the cycles, 13, 1, 2, 3, etc., up to 12; and the great cycles, 73, 1, 2, 3, etc., up to 72. On this subject he remarks as follows:

Another consideration which must be constantly borne in mind is that all Maya dates relate to elapsed time. When a date is given it must be remembered that it is not the beginning of a period yet to run its course, but the beginning of one denoting a period already concluded. The ingenious numeration of their periods was designed to prevent confusion in this regard. The first day, chuen, ahau, katun, cycle, and great cycle is not numerated 1, but 20, 18, 20, 20, 13, 73, as the case may be, denoting that the full round of the period has run and that this is the commencement of a new count. In other words, these beginning numerals are equivalent to naught or no count, the periods being designated only until after they had fully passed. It is very difficult to keep track of this style of numeration—so difficult, in fact, that familiar as I am with it I am distrustful of having made some lapses in these pages.

That he has made a mistake in this statement, in order to fit the facts with his theory, and that he carries this mistake throughout his entire work, is easily shown, and will appear from what follows.

That the count is forward to some date in the future, as compared with the initial date, in most of the series of the inscriptions, is apparent from the examples given by Mr Goodman in his work; and that it is forward to some future date, as compared with the initial day, in every initial series, must be admitted. Therefore, his assertion can not be intended to contradict this fact. What he intends to declare is this, that when a date is given, as the first day of the 2nd katun or ahau, we must understand that it is really the first day of the 3rd katun or ahau, the 2nd being completed; or when 2 ahaus and 3 chuens are mentioned, we are to understand 2 completed ahaus and 3 completed chuens.

Let us see if we can ascertain how this strange method of numbering these so-called periods originated. It must be remembered that this numbering is the consecutive numbering, as that of the days of

the month, and not the numbering (in the 13 series) of the day Ahau as mentioned above. I quote again from his work (pages 12 and 13):

Poor Don Pio! To have the pearl in his grasp and be unaware of its pricelessness—like so many others! But I must not exult too much yet. The succession of the katuns, reckoned according to this principle, is yet to be ascertained before my fancied discovery can be established by a crucial test. I score the ahaus off in the foregoing order, and, sure enough, the twentieths give the desired result: 11, 9, 7, 5, 3, 1, 12, 10, 8, 6, 4, 2, 13. Eureka! The perturbed spirit of the Maya calendar, which has endeavoured so long to impart its message to the world, may rest at last.

But, though confident I had discovered the secret of the ahau and katun count, when I tried the plan on the dates and reckonings of the inscriptions it proved totally inapplicable. There were periods into whose nature I had no insight, and if those I surmised to be ahaus and katuns were really so the former would not come in the right order, while the latter were excessive and numerated in a way quite unintelligible. It was discouraging, but I did not lose faith in my discovery. The inapplicability of the Yucatec scheme to the reckonings of the inscriptions, probably, was simply owing to different methods of computing the ahaus and katuns. There was no alternative but a patient and exhaustive analysis of the Archaic dates and time reckonings.

It would be tedious as useless to recount trials—failure outranking success a thousand fold—the results of which constitute the bulk of this book. I will only state, in brief, that I determined the character of the chuen and great cycle periods: that I discovered the first chuen was numerated 18, the first ahau, katun, day and day of the month, 20, and that the first cycle of the great cycle was numbered 13—the unit attaching to the second period in all instances; that I ascertained the cycle was composed of twenty katuns, numerated 20, 1, 2, 3, etc., up to 19, instead of according to the Yucatec order; that I finally deduced a chronological calendar whose perfect accord with the principal dates and reckonings throughout the inscriptions is proof of its correctness, and by reversing the process succeeded in reconstructing the outlines of the entire Archaic chronological scheme. I expect my calendar to be challenged. It would be without precedent in the history of discovery if it were not. But I leave it to defend itself, conscious that it is as infallible as the multiplication table, and knowing that all antagonists must finally go down before it.

By reading between the lines of this quotation, and noting the difficulties he encountered, we readily see that his theory was outlined before the difficulties presented themselves. Why should he find it necessary to number the first chuen 18, the first ahau 20, and the first cycle 13 were this not so? Take the short series 13-9-9 from 12 Caban 5 Kayab to 6 Cimi 4 Tzee, which he mentions, and says works out all right. There is no difficulty if we count it 13 ahaus plus 9 ehuens plus 9 days, just as we might say 13 hundreds 9 tens and 9. If we read it as it really is, 13 units of the 3rd order (360 each) plus 9 units of the 2nd order (20 each) and 9 units of the 1st order (1 each), there is no difficulty in showing that it is an exact measure of the lapse of time between the given dates.

The difficulty, as we may safely assume, arose from the fact that the count would not fit in with the theory he had formulated but had

not perfected. He had probably outlined the tables of his "Archaic Chronological Calendar," but instead of numbering them as we find them now given in his work, the cycles were numbered 1, 2, 3, etc., up to 13; the katuns, 1, 2, 3, etc., to 20, etc. Conceiving the idea that the numbers in the series (as the 13-9-9) should express the numbers in his scheme—that is to say, should be read the 13th ahau, the 9th chuen, and 9th day—he found that it would not give the correct result. Here indeed was a difficulty, a difficulty of fitting facts to a theory, but not one in reality, for the series taken as it stands works out correctly. In order to overcome this difficulty and at the same time save his theory he seemingly hit upon the ingenious device of a supposed Mayan method of numbering periods somewhat as the surveyor numbers his stations, beginning with 0 (naught), or what gives the same result and avoids the use of the cypher, which he contends was not used by the Mayas, of bringing forward the last number of the preceding period to be the first of the one following. Thus in his "Archaic Annual Calendar" he has pushed down one step the true dominical days, Akbal, Lamat, Ben, Ezanab, although retaining their proper numbers, and has brought forward, with the number 20 attached, the preceding days, Ik, Manik, Eb, Caban, and begins the numbering of the chuens with 18, of the ahaus and katuns with 20, etc. This, of course, overcomes the difficulty, as what is numbered the first ahau, etc., is, in fact, the second, and in the example given the 13th ahau is, in fact, the 14th, and the 9th chuen the 10th, and hence, by his method of numbering, the 13th ahau, 9th chuen, 9th day is equivalent to 13 complete ahaus, plus 9 complete chuens, plus 9 days. This plan will undoubtedly preserve the proper order of succession. The only real errors it introduces, if considered merely a method of numbering, is in making the wrong days dominicals and in carrying the last day of one month forward to become the first day of the next, one or two examples of which are pointed out in my previous paper. These examples have since been more fully discussed by Mr. Bowditch, with the result of strongly inclining him to accept Goodman's theory in this respect. They are noted in my Maya Year (figure 20), though not discussed there as to the point here raised.

As further evidence bearing on this question, I add the following: There is no such method of numbering found in the inscriptions, or in the codices, Mayan or Mexican, unless in the examples above referred to, and there is no such method mentioned by any of the early writers. Perhaps, however, the most important point to be decided in this connection is the query, Did the Mayas in fact number these so-called periods? How many were to be taken was indicated by symbols, but there is no evidence, so far as I am aware, that they were numbered, except in a single instance found

on the north and south faces of Stela J at Copan. Here, it is true, we find a succession of ahau symbols of the usual type, placed in somewhat regular order and numbered in regular succession from 1 to 16, beyond which the remaining glyphs (only two, however) are obliterated. Whether these numerals are intended as a successive numbering or intended merely to indicate so many ahaus, is not known; however, it looks like regular numbering, and is so accepted. But, unfortunately for Goodman's theory, the series clearly begins with number 1. To get around this difficulty he assumes that it is to be understood that 1 ahau has passed, yet he admits that the symbol on that numbered 1 signifies "beginning." Thus the only example of numbering these so-called periods found in all the records is emphatically against his theory, in order to sustain which he literally begs the question by saying it must be assumed as understood that 1 ahau has passed. We are justified, therefore, in regarding his scheme of numbering as wholly unnecessary to explain the numeral and time series of the inscriptions, for considering his so-called time periods merely orders of units will give a full explanation, so far as the counting is concerned, in every case.

But these items do not show all the errors in the above-quoted statement from Goodman's work. That but 13 cycles were counted to the great cycle, I have shown by mathematical demonstration is untrue, so far, at least, as the Dresden codex is concerned. I have shown that this codex, instead of counting 13 cycles to the great cycle, counts 20, thus following regularly, as would naturally be supposed, the vigesimal system. It is true that Goodman admits that the codices belonging to what he calls the Yucatec group not only count 20 cycles to the great cycle, but count from some three or four different initial days. This admission, however, does not avail him anything in the way of clearing his theory of the difficulty presented. In the first place, the Dresden codex can not be classed with the so-called Yucatec group. This group, which includes the Troano and Cortesian codices, and the codex used by Landa, makes Kan, Muluc, Ix, and Cauac the dominical days; while the Dresden codex, from which the examples given above showing the use of 20 cycles to the great cycle were taken, follows the system of the inscriptions in using throughout Akbal, Lamat, Ben, and Ezanab as dominical days. Moreover, it gives high series wholly unknown to the Troano and Cortesian codices; and it introduces in some three or four places, as numerical characters, precisely the same symbols as those of the inscriptions named by Goodman katin, ahau, and chuen, and in one or two places uses a face character to represent the ahau.

What grounds, therefore, can Goodman have for asserting that the system used in the inscriptions is different from that used in the Dresden codex, which he evidently includes under the term "Yucatec

system"? There is nothing in either the Troano or Cortesian codex by which to determine the number of cycles they count to the great cycle. What system was used in the Yucatan inscriptions is not positively known, but, as is shown below, they probably agreed with the Troano and Cortesian codices. Goodman says he has been unable to find a single Yucatec inscribed date. After careful inquiry and examination of the casts of inscriptions in the chief eastern museums and all the photographs, drawings, and figures in reach, without finding one, I have had my attention called by Mr Saville, of the New York Museum of Natural History, to a photograph by Mahler, taken at Xcalumkin, in Yucatan, which is reproduced in Le Plongeon's "Queen Moo," which, if I correctly interpret it, may be an indication of the system used in the Yucatec inscriptions. This is shown in figure 157 from a copy of the photograph kindly furnished by Mr. Saville.

The day (A11) is evidently 8 Caban, the 4th day, apparently, of the month Zotz, though the month symbol is somewhat unusual in form. If the day symbol is properly interpreted Caban, of which there can scarcely be a doubt, then, as the 4 dots over the month symbol are very distinct, it is certain (whether we can determine the month symbol or not) that the year must begin with the day IX, hence the dominical days must be Kan, Muluc, IX, and Cauac. This is the calendar system of the Troano and Cortesian codices and also of the codex followed by Landa. This result I must confess is contrary to my expectation and carries back the Yucatec calendar system to the days of the inscriptions. It is true that a single inscribed date is a slender basis on which to reach a decision, but we must accept it until other evidence on the point is forthcoming. Goodman suggests that the Cocomes, Xius, Chels, and Itzas had each their own "chronological system, using a

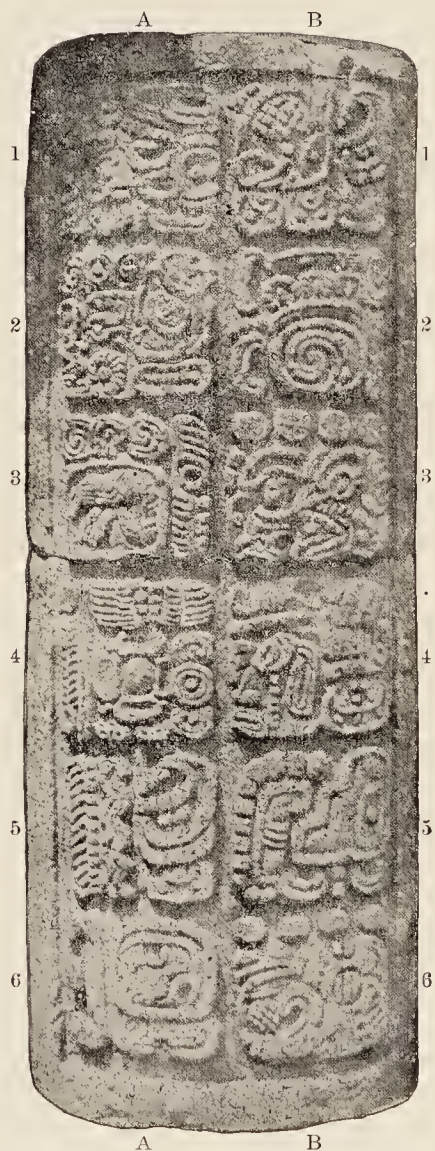
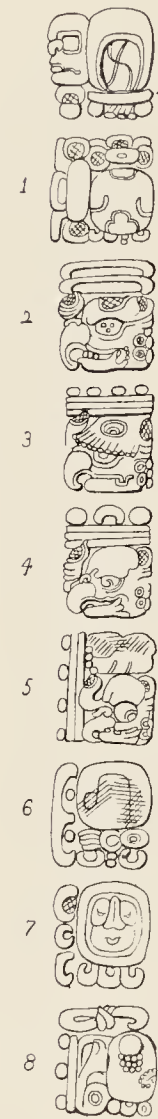


FIG. 157. Inscription at Xcalumkin, Yucatan. From a photograph by Mahler.

common calendar.” On what he bases this opinion, which is equivalent to saying they had different numeral systems, I am not aware. That the system in vogue at Tikal (in the Itza region of the Peten district) was the same as that of the inscriptions at Palenque, Copan, and Quirigua is well known.

Let us return to the exceptional series of the Copan inscriptions mentioned above (west side of Stela N). Although it was discussed at some length in my previous paper, a reexamination has brought to light some facts overlooked in the first examination, which have an important bearing on the question involved; and they will be noticed here. This series reversed is as follows: 14-17-19-10-0-0 to 1 Ahau 8 Chen (figure 158). Written out it is 14 great cycles, 17 cycles, 19 katuns, 10 ahaus, 0 chuens, 0 days, to 1 Ahau 8 Chen. Changed into days it gives the following result, counting 20 cycles to the great cycle:



	Days
14 great cycles.....	40,320,000
17 cycles	2,448,000
19 katuns.....	136,800
10 ahaus.....	3,600
<hr/>	
Total.....	42,908,400
Subtract 2,260 calendar rounds.....	42,894,800
<hr/>	
Remainder	13,600

If we count back this number of days from 1 Ahau 8 Chen, year 3 Ben, it brings us to 12 Ahau 13 Zotz, year 5 Lamat, which will be the first day of the first, or most remote, of the 14 great cycles, counting the series in this manner upward from the 15th:

- 1st great cycle
- 2nd great cycle, etc., to
- 14th great cycle
- (15th great cycle)
- 17 cycles
- 19 katuns
- 10 ahaus
- 0 chuens
- 0 days

FIG. 158. Part of inscription on the west side of Stela N, Copan. Maudslay, part 4, plate LXXIX.

If we count back from the same date (1 Ahau 8 Chen) the 17 cycles, 19 katuns, and 10 ahaus, we reach the first day of the (incomplete) 15th great cycle as we have numbered them above. This day is 5

Ahau 8 Cumhu, year 9 Ben. If we count back the great cycles one by one (counting 20 cycles to a great cycle), we shall find the initial dates to be as follows—the numbers given the great cycles being, of course, arbitrary:

1st great cycle.....	12 Ahau 13 Zotz, year 5 Lamat
2nd great cycle.....	5 Ahau 3 Ceh, year 4 Ezanab
3rd great cycle.....	11 Ahau 8 Pop, year 4 Ben
4th great cycle.....	4 Ahau 18 Mol, year 3 Akbal
5th great cycle.....	10 Ahau 8 Pax, year 2 Ben
6th great cycle.....	3 Ahau 13 Tzec, year 2 Lamat
7th great cycle.....	9 Ahau 3 Mac, year 1 Ezanab
8th great cycle.....	2 Ahau 8 Uo, year 1 Ben
9th great cycle.....	8 Ahau 18 Chen, year 13 Akbal
10th great cycle.....	1 Ahau 8 Kayab, year 12 Ben
11th great cycle.....	7 Ahau 13 Xul, year 12 Lamat
12th great cycle.....	13 Ahau 3 Kankin, year 11 Ezanab
13th great cycle.....	6 Ahau 8 Zip, year 11 Ben
14th great cycle.....	12 Ahau 18 Yax, year 10 Akbal
15th great cycle.....	5 Ahau 8 Cumhu, year 9 Ben

This result shows our calculation to be correct, taking the day of the inscription (1 Ahau 8 Chen) as that from which to count back. As there are 14 complete great cycles, which we estimate at 20 cycles each, and the minor periods (17 cycles, 19 katuns, and 10 ahaus), the latter must fall in the 15th great cycle, which is incomplete. Counting back these minor periods, we reach, as has been stated, 5 Ahau 8 Cumhu, year 9 Ben, as the first day of this 15th great cycle. Counting back from this latter date 20 cycles (or 1 great cycle) we reach 12 Ahau 18 Yax, year 10 Akbal, the first day of the 14th great cycle, and so on to the initial day of the first, which we find to be 12 Ahau 13 Zotz, year 5 Lamat, giving exactly the same result as our calculation of the whole as one single series. By both methods the first day of the entire series, and hence the first great cycle as numbered above, is found to be 12 Ahau 13 Zotz. But this, though correct so far as calculation is concerned, is not proof, as the results given must necessarily follow if the date counted from is 1 Ahau 8 Chen, and 20 cycles are counted to a great cycle. This is unsatisfactory, as it fails to bring in as the first day of a great cycle 4 Ahau 8 Cumhu, which was a normal date at Copan.

I am strongly inclined to believe that the terminal date of the series instead of 1 Ahau 8 Chen, as given in the inscription, should be 13 Ahau 8 Chen, which falls in the year 2 Ben. If we count back from this date 17 cycles, 19 katuns, 10 ahaus, 0 chuens, 0 days, it will bring us to 4 Ahau 8 Cumhu, year 8 Ben, as the first day of the 15th great cycle, as we have arbitrarily numbered them above. If we count back the entire series, 14-17-19-10-0-0, from 13 Ahau 8 Chen, year 2 Ben, it brings us to 11 Ahau 13 Zotz, year 4 Lamat, as the first day of the 1st

great cycle as numbered above. The first days of the great cycles would then be as follows:

1st great cycle.....	11 Ahau 13 Zotz, year 4	Lamat
2nd great cycle.....	4 Ahau 3 Ceh, year 3	Ezanab
3rd great cycle.....	10 Ahau 8 Pop, year 3	Ben
4th great cycle.....	3 Ahau 18 Mol, year 2	Akbal
5th great cycle.....	9 Ahau 8 Pax, year 1	Ben
6th great cycle.....	2 Ahau 13 Tzec, year 1	Lamat
7th great cycle.....	8 Ahau 3 Mac, year 13	Ezanab
8th great cycle.....	1 Ahau 8 Uo, year 13	Ben
9th great cycle.....	7 Ahau 18 Chen, year 12	Akbal
10th great cycle.....	13 Ahau 8 Kayab, year 11	Ben
11th great cycle.....	6 Ahau 13 Xul, year 11	Lamat
12th great cycle.....	12 Ahau 3 Kankin, year 10	Ezanab
13th great cycle.....	5 Ahau 8 Zip, year 10	Ben
14th great cycle.....	11 Ahau 18 Yax, year 9	Akbal
15th great cycle.....	4 Ahau 8 Cumhu, year 8	Ben

The method of numbering the great cycles must be understood as wholly arbitrary, given merely for convenience, and to include the 15 that are referred to in the count. I do not believe that there was any consecutive numbering of these supposed time periods in the sense indicated by Goodman; in fact, as I expect to show, they were not time periods in any true sense of the term.

The reason for believing that the date following the inscription should be 13 Ahau 8 Chen instead of 1 Ahau 8 Chen is that 4 Ahau 8 Cumhu, as appears from the inscriptions at Copan and Quirigua, was the favorite initial date, most of the initial series going back to it, and that counting back the minor periods of the series from 13 Ahau 8 Chen brings us to 4 Ahau 8 Cumhu. If we turn to Goodman's "Archaic Chronological Calendar" and count forward, from the beginning of his 54th great cycle, 17 cycles, it will bring us to the 4th cycle of his 55th great cycle, and to the 19th katun of this cycle and the 10th ahau of this katun, where we find the day to be 13 Ahau 8 Chen. We are therefore of the opinion that the terminal day of the long series should be 13 Ahau 8 Chen, and that Goodman is wrong in rejecting it. As there are 17 cycles, it proves, as it stands, that the authors of the inscriptions counted 20 cycles to the great cycle, which is consistent with their system of numeration. I have shown in my previous paper why 1 Ahau 8 Zip can not be the initial date of this series.

As bearing on the explanation of this series, the following facts in regard to the symbols are worthy of special notice. It will be seen by an inspection of the series shown in figure 158 that the great cycle symbol (glyph 5) is a face character very much like that of the cycle, except that it has a superfix, which unfortunately is too nearly obliterated to be traced. However, it is noticeable that in both it and the cycle symbol the hand figure is across the lower jaw. According to Goodman, "the hand on the cheek, the thumb or wrist forming the

lower jaw, usually characterizes the face sign for 20" (page 52), and this conclusion is sustained by the evidence we have given above. Goodman's perverseness in contradicting his own evidence in order to maintain his theory is shown in reference to this sign. It is found almost universally on the cycle face characters, as may be seen in his examples on page 25 of his work. It is true that it may be contended, as Goodman in fact does contend, that it signifies that 20 of the next lower order make one of this order. Admit this; it follows that when the same sign is found on the great cycle symbol, it signifies that 20 of the next lower order (or cycle) make one great cycle. Although but one example of the great cycle face symbol has been found, it bears clearly and unmistakably this hand sign, and not only is this not denied by Goodman, but is accepted by him and copied as an example of the symbol of this period on page 25 of his work.

Thus it will be seen that from whatever side we view the evidence bearing on this question, it is against Goodman's theory of only 13 cycles to the great cycle. However, before closing the discussion of this point I desire to call attention to one other series, found on Stela C of Quirigua, which seems to have a bearing on the question. This is as follows: 54-13-0-0-0-0, 4 Ahau 8 Cumhu—in other words, 54th great cycle, 13 cycles, 0 katuns, 0 ahaus, 0 chuens, 0 days, to 4 Ahau 8 Cumhu, the 13 being the ordinary numeral symbols, dots and short lines, and very distinct. Goodman's only comment (page 127) is, "This date is the beginning of the 54th great cycle." As 4 Ahau 8 Cumhu, is, according to his reckoning, the initial day of the 54th great cycle, the series, according to this explanation, covers no lapse of time whatever. Yet, according to his theory, the numbers in these series always relate to time which has elapsed. Hence the 13 cycles relate to 13 of these so-called periods which have passed and still signify no time whatever. This is a palpable contradiction into which he has been led in his effort to maintain an erroneous theory. If he had written the series "53-13-0-0-0-0 to 4 Ahau 8 Cumhu," it would have been correct so far as the count is concerned.

Dr Seler in his able article, "Die Monumente von Copan und Quirigua und die Alter-Platten von Palenque" (*Zeitschrift für Ethnologie*, Heft 6, 1899, pages 670-738), makes some remarks in regard to the series above noticed to which it is desirable to call attention.^a

It appears from this article that he follows Goodman in counting 13 cycles to the great cycle, or 13 units of the 5th order to make one of the sixth (I repeat again that Goodman's terms are used merely for convenience). Moreover, he seems to look upon these as real time periods. That he, who is so familiar with the subject, has not

^aThis article was not received by me until all this paper, except the last few pages and the notices of it which have been inserted, had been written. As I have seen no reason, because of Seler's article, to change anything previously written, I make this statement as due to myself.

entered into a careful examination of the basis on which Goodman's theoretical "Chronological System" rests, and that he has accepted Goodman's theory of 13 cycles to the next higher period, without thoroughly testing it, and noting the 20 cycles of the Dresden codex, is somewhat surprising to me. However, he may have reserved the discussion of these points for a future article.

In speaking of the series last referred to, 54-13-0-0-0-0, 4 Ahau 8 Cumhu, he says:

Here one sees that the final date is the normal date itself. Its distance from the normal date can be placed only at 0 or the above-named immense period of 18,720 years. The builders of the monuments have done neither. They have provided all the lower multiplicands, or smaller periods, with the index 0, but to the highest and greatest they have placed the multiplier 13. Thirteen is the number of the index figures which are possible with the tun, the katun, and the cycle names. If, consequently, here at the beginning of the initial series the thirteen cycles are named, nothing else is meant than "the periods or epochs generally." And the whole initial series would consequently give about the following idea: "This is a chronological monument. The beginning of the numbering is the day 4 Ahau 8 Cumku." And the fact that on the west side of the same stela another definite date and its distance from the normal date is named agrees very well with this.

Similarly, in my opinion, are to be understood the thirteen cycles which are chiseled on the two sides of Stela C of Copan, immediately under the katun signs, the initial and chief hieroglyphs.

It seems clear from this that he has adopted Goodman's interpretation of the series, unaware of its incongruity with the interpretation of all the other initial series, and the fact that it stands in opposition to his own conclusion stated a little farther on in the same article. As proof of the latter statement, I refer to the quotation from his article given hereafter (page 292).

Now, it is apparent that, if the series be interpreted as signifying no lapse of time, but as a mere assertion that the date of the event commemorated was 4 Ahau 8 Cumhu the first day of the 54th great cycle, which interpretation Seler adopts, then the monument must have been erected 3,550 years before the beginning of the cycle which he numbers the tenth (Goodman's ninth). It is apparent, therefore, that he has failed to see the contradiction between this statement and that which places the erection of the monuments of Copan and Quirigua in the tenth cycle. He objects to the lapse of 3,160 years between the erection of the monuments of Palenque and those at Copan and Quirigua, as improbable, but here admits, by his interpretation, a lapse of 3,550 years between monuments at Quirigua.

I have stated above that Goodman's so-called time periods, chuens, ahaus, katuns, etc., are in reality nothing more than orders of units, or steps in numeration. Although this point has been discussed to some extent in my previous paper, I will add here some further evidence bearing on it.

As a means of illustrating the use of numbers by the Mayas, in relation to time, the following example—which is part of a series on plate LIX of the Dresden codex (figure 159)—is presented:

•	•				
—	•	—	—	—	...
•••	—	•••	•••	—	•••
13 Caban	13 Cauac	13 Imix	13 Akbal	13 Chicchan	13 Manik

As this series ascends toward the left hand the forward count will be in that direction. Starting with the column at the right hand, we subtract it (3-18) from the next one to the left, and this one from that immediately to the left of it, and so on to the last.

The difference in each case is found to be 3-18; that is, 3 twenties (3×20) plus 18 equal 78 days, the day being the unit. Counting for-

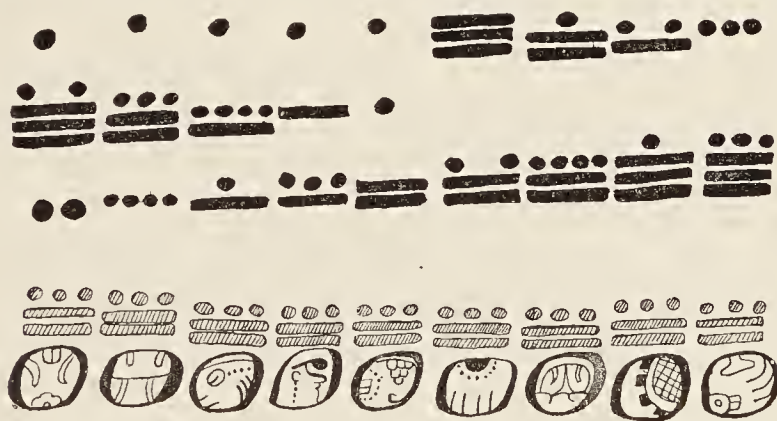


FIG. 159. Lower division of plate LIX, Dresden codex.

ward 78 days from 13 Manik of any year (say 13 Manik 20 Zotz, year 12 Lamat) we reach 13 Chicchan (in this case 18 Mol, same year). Counting forward 78 days from the last date we reach 13 Akbal 16 Ceh, same year; 78 more (always counting from the last date), 13 Imix 14 Pax, same year; 78 more, 13 Cauac 7 Uo, year 13 Ben. If we count back 78 days from 13 Manik 20 Zotz (first column at the right hand), we reach 13 Muluc 2 Pop, year 12 Akbal, which is the initial day of the whole series, the month and year of the first given day being as assumed above.

Attention is called to this series not because it presents any peculiar feature, but to show that considering the numerals merely as numbers in respective orders of units will furnish a full and satisfactory explanation of their object and use. I take for granted that the simplest explanation, if it meets every requirement and presents nothing inconsistent with the known facts regarding the Maya time

and numeral systems, should be accepted rather than a theory which introduces new and hitherto unknown features.

If we use ordinary numbers in place of the numeral symbols, and keep them in the relative positions given above, the result will be as follows:

3rd order of units.....	1				
2nd order of units.....	1	15	11	7	3
1st order of units.....	10	12	14	16	18
	13 Cauac	13 Imix	13 Akbal	13 Chicchan	13 Manik

If we assume these to be successive orders of units indicated by relative position, increasing upward, the day being counted as the primary unit and the vigesimal system being used, except in passing from the second to the third order, where the multiple is 18, all the requirements of the series will be met. Thus, in the first, or right-hand, column, we have 18 units of the 1st order and 3 of the second, or $3 \times 20 = 60$, making together $60 + 18 = 78$; and in the second column 16 of the 1st order and 7 of the 2nd order, or $7 \times 20 = 140$, making together $140 + 16 = 156$, and so on to the fifth column, where we find 10 of the 1st order, 1 of the second, or $1 \times 20 = 20$, and 1 of the 3rd order, or $18 \times 20 = 360$, making together $360 + 20 + 10 = 390$. These numbers give correct results, as, counting 78 days from 13 Muluc, we reach 13 Manik; counting 156 from the same initial date, we reach 13 Chicchan, or counting 390 days, we reach 13 Cauac. It is clear, therefore, that if we take these numerals to indicate the number of different orders of units, the orders being indicated by relative position, all requirements of the series are satisfied and the proper results are obtained.

If we take one of the high series we find that precisely the same rule obtains, as, for example, one of those on plate LXII, Dresden codex (see plate LXXIX):

4 of the 6th order of units.....	4
6 of the 5th order of units.....	_____	6
9 of the 4th order of units.....	_____	9
15 of the 3rd order of units.....	_____	15
12 of the 2nd order of units	_____	12
19 of the 1st order of units	_____	19

This is upon precisely the same principle as our method of expressing numbers, except that it is according to the vigesimal system, while we use the decimal. Take the number 643,527, where the relative positions express the relative values, it becomes possible to represent the number thus:

- 6 hundred thousands
- 4 ten thousands
- 3 thousands
- 5 hundreds
- 2 tens
- 7 units

If, instead of adding the written names, simply the figure should be given, the relative positions being maintained and understood, we would have the Maya method, and the value would be known as well as by our ordinary method of writing numbers horizontally.

I have given these details of elementary rules and principles in order to lead up to this point, viz, that symbols may be used to indicate orders of units instead of position. In the last example given above, a symbol may be adopted for the "hundred thousands," another for "ten thousands," another for "thousands," etc. They may then be grouped in any regular order most convenient, and yet be as correctly read as by position. This is precisely what has been done in the inscriptions. Symbols have been adopted to indicate the orders of units, as it was inconvenient to do this by means of relative position alone with the dots and short lines—at any rate it is apparent that the latter method is not so well adapted to the glyph form in the inscriptions; but even here we see a strong tendency to maintain the relative position which almost universally obtains and is often the only means of determination. If we take Goodman's work and go through it from beginning to end and substitute in every series where they occur "units of the 2nd order" for his *chuen*s, "units of the 3rd order" for his *ahau*s, "units of the 4th order" for his *katun*s, "units of the 5th order" for his cycles, and "units of the 6th order" for his great cycles, the result will be correct in every instance. I am fully aware that this will be true whether we call them real time periods or orders of units. The point, however, for which I am contending is, that as the Mayas had a system of numeration and must have used it in expressing numbers in the codices and inscriptions, and this numeral system corresponds exactly with Goodman's supposed time periods so far as these are given numerically correct by him, there is no necessity or reason for the theory of a separate Maya chronological system (identical so far as correctly given with the Maya numeral system as used in counting time), differing from their calendar system.

From the evidence given in the earlier part of this paper and what has been presented in my preceding paper, the following conclusions appear to be clearly justified:

That Mr Goodman has discovered independently the signification and numeral values of the symbols found in the inscriptions which he designates by the names cycle, katun, ahau, chuen, and calendar round, though this had been already done in part by others.

That he has discovered that certain face and other characters are number symbols, and has ascertained their values.

That he has determined the object and use of the numeral series, and the method of counting by the same series from the preceding and following dates, as well as to them.

It is also equally apparent that his theory of a Maya chronological system, distinct from the Maya calendar system—the Mayan method of numeration in counting time—and his method of counting 13 so-called cycles only to the so-called great cycle and 73 great cycles to his so-called grand era are not justified by the facts, nor is his method of numbering the cycles, katuns, etc., beginning with 73, 13, and 20, satisfactorily proved; and also that his selection of Ik, Manik, Eb, and Caban as the dominical days is erroneous, the true dominical days being Akbal, Lamat, Ben, and Ezanab, both in the inscriptions and Dresden codex.

Let us turn next to his method of numbering the so-called great cycles. According to his theory, as we have seen, 73 great cycles are counted to what he calls the grand era, the common multiple of all the factors of the calendar system and supposed “chronological system.” The reason why he adopted this theory is explained in my previous paper, and the explanation need not be repeated here, except so far as merely to state that in order to find a common multiple of the various time periods, one must include the number 365, which contains the prime number 73.

That there was in the Maya system a number or order of units corresponding with Goodman’s great cycle is certainly true, but this pertained to their numeral, and not their time, system. It is also admitted that the large quadruple glyph that usually heads the initial series is the symbol used to represent this number or order of units. But, as has been shown, there is no reason whatever for believing that they were numbered otherwise than in accordance with the vigesimal system; that is to say, 20 cycles to the great cycle, and 20 great cycles to the next higher unit. It is necessary, therefore, for Goodman, before his theory can be accepted, to show by satisfactory evidence that, on reaching the cycles and great cycles, the ordinary method of proceeding by the vigesimal system was abandoned and other multiples were introduced. That there was a change from this rule in passing from the 2nd order of units, or chuens, to the 3rd order, or ahaus, where 18 was made the multiple, is proved by incontrovertible evidence and hence must be admitted, even though we may not be able to show by absolute demonstration why the change was made. Nevertheless, we are justified in believing that, in this instance, the method of numeration was made to correspond with the number of months in the year. But no such reason appears for Goodman’s proposed change in the higher orders of units; we are, therefore, justified in rejecting the idea until other proof, besides its necessity to support a theory, is shown. It must be made evident by proof that the series can not be otherwise explained, which we have shown is not the case, or it must be shown that the great cycle symbols present, by their forms, the numbers assigned them.

Before referring to the numbers of the great cycles as obtained by a study of the forms of the symbols, I introduce the following quotation from Goodman's work (page 38):

The number and diversity of these signs and the fantastic character of some of them—notably the face series—suggest a hieratic design to conceal the purport of the inscriptions from the uninitiated; but I think the determinative feature of their numeration, the desire to give symmetry and grace to their glyphs, and the possible purpose to avoid sameness and repetition, sufficiently account for the variety without ascribing it to a cryptogramic intention. It is probable, therefore, that all the other series of numerals were as intelligible to the populace as the simple one of dots and bars—being, as it were, a mere difference in the style of characters, such as is to be seen in fancy printing or ornamental sign-writing.

While it is likely that in most instances there is a full series of similar signs, just enough modified to distinguish them from each other, running from 1 to 20, I do not think this to be the case throughout. It will be found, I believe, that there are many sporadic signs, or signs without any serial connection. The frequent use of certain numbers accounts for this, and it is to designate these that solitary symbols are oftenest employed. There will probably be more signs discovered for 13, 18, and 20, than for any other number.

I do not claim that the value of any sign about to be given is correct beyond question. On the contrary, I think it very likely that in some instances I shall myself find reason for a change. But, as in most cases I shall explain why I have attached the value given to particular signs, the reader will not be misled, but can accept, reject, or modify my estimate, according to his own judgment. It will be only by persistent trial, assumption, alteration, and readjustment, until a figure that fulfils the requirement of every condition under which a character appears is hit upon, that we shall be able to fix the values of all the numeral signs.

That the great cycle symbol can be determined by position in a series, even though imperfect in form, is evident from what has been shown, but the number must be determined otherwise. In order to show on what Goodman bases his conclusion as to the numbers of the great cycles so far as determined by the form, I quote the following from his work (page 83):

ELEMENTS OF THE GREAT CYCLE SIGN

Here the reckoning reverts to the 5-day period. It is multiplied by 72, making an ahau; that by 20, making a katun; that by 20 again, making a cycle; and that by 13, making a great cycle. The last multiplier is the outflaring trinal character at the top [figure 160]. It is a 13 sign, duplicated to balance the glyph. The two 20 multipliers appear only in the first of the symbols given above—or, rather, only in that does the single one extend all the way to the bottom, as is commonly the case. There should be two separate signs, however, as shown in some of the glyphs; but I have selected these particular specimens for another purpose, which I shall presently state. The 20 sign in the first glyph looks like anything but the same sign in the other two, and resembles a fish more than anything else. Yet they are identical in character, both representing the feathered dragon, the fringed jaw alone of which, reduced to the cursive comb-like character, is the commonest sign for 20. The evolution of this character is so curious and

interesting that I herewith give a series of glyphs, all taken from great-cycle symbols, showing the gradations [figure 161].

The reason why I selected the particular symbols given above, is that I think the number of the great cycle is specifically stated in them. Close observers will have noticed several peculiar things about the great-cycle character. The most peculiar of these is that, while the form of the katun symbol is preserved in it fully in every other respect, the *cauac* sign disappears from the superfix and is replaced by some other character. In more than three-fourths of the dates in the 54th great cycle a dragon's head occupies its place; a tiger's head predominates in the 55th, while the remainder is made up of faces and signs that may represent a day, a cycle, or some other period. Whatever their character, they have no

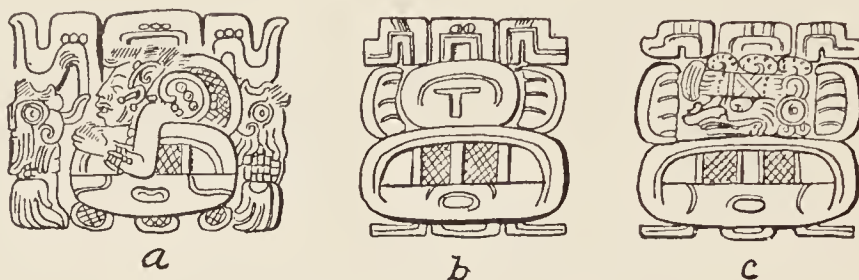


FIG. 160. Great cycle symbols. Goodman, page 83.

peculiarities that can at present be construed into numerals, except in case of the three glyphs here reproduced; so, if the others have any numeric value, it must be arbitrarily expressed. The three in question indicate the 54th great cycle, and I think that all of them announce that fact, but each in a different way. The center of the katun superfix in the first is composed of a sign for 18 and a face. If it were plainly the face for 3 we should be left in no doubt; but, in consequence of the defacement of the stone, it is impossible to determine if a band—the characteristic of the 3 head—extends across the forehead or not. In the second glyph the *ik* symbol—a sign for 6—appears in an inclosure that probably represents 9, but as the coil is not clearly discernible we are again left in uncertainty. The third glyph has the meaningless face, which elsewhere serves as a mere vehicle

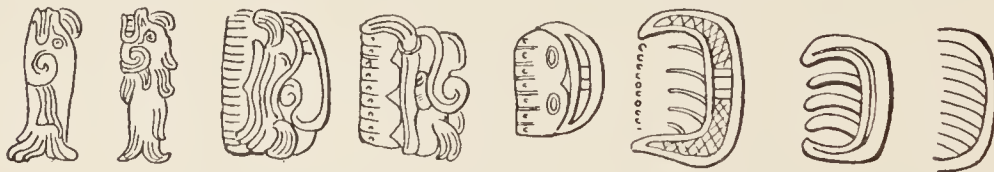


FIG. 161. Comb-like symbols for 20. Goodman, page 83.

for numerals, bearing a sign for 9, surmounted by three objects evidently intended for spheres, whose value is doubled by the dotted lines in them, rendering it probable that the combination was designed to express $9 \times 6 = 54$. I make no claim to absolute certainty in any of these cases; but, however uncertain the renderings may be separately, they collectively derive a high degree of probability from a single significant fact. The unmistakable numeral sign in each glyph is a divisor of 54. That these glyphs—the only ones with recognizable numerals—should contain signs for three out of the six numbers by which 54 is divisible, is a circumstance too singular to be attributed to accident when a more reasonable explanation is to be found in the theory that these three particular figures were chosen with the definite purpose of arriving at that number.

As Goodman admits in the passage quoted, it is only in the three great cycle signs presented (see figure 160) that the evidence of numbering is found; let us examine this evidence. "Here," he says, "the reckoning returns to the 5-day period. It is multiplied by 72, making an ahau," yet he fails to allude to anything in the figure to justify the statement. That the comb-like characters and their substitutes have the value of 20 is probably correct, the sign being duplicated, as Goodman suggests, for the sake of symmetry. The fair inference is that in the katun symbol they indicate that this time period or order of units is equal to 20 ahaus ($20 \times 360 = 7,200$). This admission, however, as will be seen, is fatal to Goodman's theory.

The three figures given represent, according to this author, the 54th great cycle, and indicate by the details, but each in a different way, the number 54. This, he says, is shown in the first (*a*) in the center of the superfix, where he finds a sign of 18 and a face denoting 3—though he admits that the latter is too imperfect for positive determination. The fact is that he has presented no proof that the dotted coil denotes 18. He asserts in his explanation of the ahau series on Stela J, Copan, copied in full in my previous paper, that the double coil denotes 18, but gives no proof to sustain the statement. His symbol for 18 in the ear ornament (page 87) is wholly different. Moreover, the face in the superfix, so far as the details remain, corresponds in no respect with the face numerals for 3 given on page 43 of his work, but on the contrary bears a strong resemblance to at least two of the face characters for 1 (page 42). It is unnecessary to follow him in order to find the desired number in the other two figures (*b*, *c*), as not a particle of proof is offered to sustain his assertions. It is apparent from his language that he felt his attempt here was a failure, but it was necessary to offer something on the point in behalf of his theory. Why 54 was given as the number of this great cycle, which begins with the day 4 Ahau 8 Cumhu, is apparent from the great-cycle column of his "Perpetual Chronological Calendar"; but his reason for beginning the series with 4 Ahau 13 Yax will be referred to farther on.

In order to make clear what is stated below in regard to the forms and details of the symbols of the great cycle, katun, etc., a number of the types of the great-cycle symbol are shown in figure 162; of the ahau in figure 163; of the katun in figure 164; and of the cycle in figure 165.

That this symbol—several varieties of which are shown in figure 162 (also seen in figure 160, and as initials in plates LXXI–LXXIII, LXXV, LXXVI, and LXXVIII, and figures 146, 147, 151, and 158)—is built up from, or based on, the 360-day or ahau symbol of the ordinary form, as shown in number 9, figure 163, is evident. The katun symbol of the ordinary type (*k*, figure 164), has the same body form as the ahau symbol, but there is added a superfix consisting of a comb-like figure on each side, with a middle character usually resembling a Cauac symbol.



FIG. 162. Types of great cycle symbols from the inscriptions. 1, Stela E, Copan, Maudslay, part 3, plate XLIX; 2, Stela I, Copan, Maudslay, part 3, plate LXV; 3, Stela D, Quirigua, west side, Maudslay, part 12, plate XXVI; 4, Stela D, Quirigua, east side, Maudslay, part 12, plate XXV; 5, Stela J, Quirigua, Maudslay, part 12, plate XLVI; 6, Stela K, Quirigua, Maudslay, part 12, plate XLIX; 7, Monolithic Animal B, Quirigua, Maudslay, part 11, plate XIV; 8 and 9, Stela C, Copan, Maudslay, part 2, plate XLI (both specimens on this plate); 10, Stela A, Copan, Maudslay, part 2, plate XXX; 11, Altar S, Copan, Maudslay, part 4, plate XCIV; 12, Stela N, Copan, east side, Maudslay, part 4, plate LXXIX; 13, Stela N, Copan, west side, Maudslay, part 4, plate LXXIX, glyph 14, counting from the top; 14, supposed great-cycle symbol from the Dresden codex, plate XLIII.

This is an evident approach to the great-cycle symbol, as may be seen by comparing number 9, figure 163, with the types of the usual form shown in numbers 1 and 2, figure 162. The usual cycle symbol or symbol of the 5th order of units (figure 165 and figure 148) does not follow the ahau type, being wholly different in form. But an examination of the great-cycle symbols given in numbers 1 and 2, figure 162, and in the other figures referred to above shows clearly that they are based on the ahau symbol. If the additions to the ahau symbol in order to form this symbol have any number signification—and it is reasonable to suppose that they do, as the symbols are numeral characters—then Goodman is probably right in assuming that the comb-like figures (the center character being variable) denote 20 as a multiple. The ordinary cycle symbol varies from the ahau type, being made up of two Cauac characters; but these have the same sig-



FIG. 163. Types of the ahau (360) symbol.

nification, if Goodman be right, as the comb-like figures in the katun and great-cycle symbols—that is, 20. Of this, however, we have no positive proof, except it be found in the symbol itself, where the character is, or the two combined are, beyond question, used to represent a number. An examination of the face characters for this period or order of units shows that, as a general rule, the symbol of 20 or full count (equals 0) (see figure 144) is present in the form of a hand across the lower jaw. We have also called attention to the fact that the only face character of the great cycle found in the inscriptions (see glyph 5, figure 158) has the hand across the lower jaw, indicating that it is equivalent to 20 of the next lower order, that is, 20 cycles.

There is, in fact, seemingly positive evidence that the superfix of the great-cycle characters does not and can not give the number 54, as those which represent this great cycle, be its number what it may, differ from one another, as will be seen by reference to figure 162,

numbers 2 to 12. Having worked out his system in tabular form, Goodman finds that 4 Ahau 8 Cumhu is the first day of his 54th great



FIG. 164. Types of the katun symbol.

cycle, assuming, as he does, that 4 Ahau 13 Yax was the first day of his grand era. The particular process by which he reached the con



FIG. 165. Types of the cycle symbol.

clusion that 4 Ahau 13 Yax was the initial day of his first great cycle, and hence of his grand era, is not clear. The choice was apparently

arbitrary, though it was necessary that the date chosen should make connection with 4 Ahau 8 Cumhu as the first day of a great cycle. His explanation of the grand era, on pages 26 and 27 of his work, shows the relation of the minor periods to it according to his theory, but does not give the reason for selecting 4 Ahau 13 Yax as the initial date. On page 34 he speaks of the date as an important one in the inscriptions, but still does not give the reason for making it the beginning of the grand era.

That any other 4 Ahau, which would bring 4 Ahau 8 Cumhu as the first day of a great cycle, would answer as well as 4 Ahau 13 Yax, even on his theory, is easily shown. As the Mayan time count is an orderly round, a given day recurring at the end of a certain period, it is evident, as everyone acquainted with the system knows, that the count of periods may begin at any point, unless some fixed point in the series is found with its proper number. One check in this respect found in the inscriptions is the fact just mentioned that, according to Goodman's system, 4 Ahau 8 Cumhu appears to be the initial day of a great cycle, and the initial dates of the other great cycles must fit correctly with this determined initial date—that is to say, following his theory and counting 13 cycles to the great cycle, these initial dates must all be a day 4 Ahau. Another possible check is the long series in the Copan inscription, which goes back 14 great cycles preceding that beginning with 4 Ahau 8 Cumhu.

Let us turn to Goodman's "Perpetual Chronological Calendar," to the great-cycle column. Suppose that instead of commencing with the date 4 Ahau 13 Yax, with which he begins the grand era, we begin with 4 Ahau 18 Zotz, the initial day of his 40th great cycle. The series will then be as follows, if we adopt his method of numbering:

73. 4 Ahau 18 Zotz	18. 4 Ahau 8 Pop
1. 4 Ahau 18 Cumhu	19. 4 Ahau 8 Muan
2. 4 Ahau 13 Kankin	20. 4 Ahau 3 Zac
3. 4 Ahau 8 Yax	21. 4 Ahau 18 Xul
4. 4 Ahau 3 Xul	22. 4 Ahau 13 Uo
5. 4 Ahau 18 Pop	23. 4 Ahau 13 Pax
6. 4 Ahau 18 Muan	24. 4 Ahau 8 Ceh
7. 4 Ahau 13 Zac	25. 4 Ahau 3 Mol
8. 4 Ahau 8 Yaxkin	26. 4 Ahau 18 Zip
9. 4 Ahau 3 Zip	27. 4 Ahau 18 Kayab
10. 4 Ahau 3 Kayab	28. 4 Ahau 13 Mac
11. 4 Ahau 18 Ceh	29. 4 Ahau 8 Chen
12. 4 Ahau 13 Mol	30. 4 Ahau 3 Tzec
13. 4 Ahau 8 Zotz	31. 4 Ahau 3 Uayeb
14. 4 Ahau 8 Cumhu	32. 4 Ahau 18 Kankin
15. 4 Ahau 3 Kankin	33. 4 Ahau 13 Yax
16. 4 Ahau 18 Chen	34. 4 Ahau 8 Xul
17. 4 Ahau 13 Tzec	

And so on to the 72d, the next being 4 Ahau 18 Zotz, with which the numbering began.

This will meet every requirement, including the limitations above mentioned, as fully and as completely as the series given by Goodman, even if we hold to his theory of 13 cycles to the great cycle and 73 great cycles to his grand era, and follow his own method of counting. The same thing is true if we select, as the first great cycle, any other of the 40 which precede that with which we began the count.

There is another fact which appears to conflict with Goodman's theory and, indeed, to be irreconcilable with it. According to this theory, the grand era, consisting of 136,656,000 days, is the least common multiple of all the different factors of the regular calendar as well as of his chronological calendar, at the beginning of which all the periods start anew on their grand round. That this number is the common multiple of all these periods or factors is true. But how are we to reconcile the theory with the fact that he begins this great era with the day 4 Ahau 13 Yax, which is certainly not the beginning day of a year or of a month? It is true the 136,656,000 days is an exact multiple of 365, but, starting the count of 365 with the day 4 Ahau 13 Yax makes the latter number a mere numeral factor; no regular Mayan year could begin with the day 4 Ahau or with the 13th day of the month Yax. From February 1, 1899, to the following January 31, in our time system, is a year's time, but the period is composed of parts of two calendar years.

Goodman's theory, in order to be correct and keep the time periods in proper order, if his grand era is a true and absolute rounding-out period of all the minor periods, absolutely requires that this great period shall begin with the 1st day (or 20th if he prefers this numbering) of the month Pop, and the first year of the 52-year cycle or calendar round. Otherwise, when the era ends, it will be in the middle of a year, as it will if it begins on 4 Ahau 13 Yax, and closes with 3 Cauac 12 Yax.

The question next in importance is, are his tables correct, though based on an erroneous theory? Those of the first series, termed the "Archaic Annual Calendar," are nothing more than the ordinary calendars of the 52 years of what has heretofore been termed a "cycle," but to which he applies the name "calendar round," each year being given separately. They are all contained in my condensed calendar. This is nothing new, as the method had been in use for a number of years before Goodman commenced his investigations. As his "Archaic Chronological Calendar" is nothing more than a continuous series of ahaus, or 360-day periods, using Ahau as the "initial day" through 39 of the 5th order of units, following one another in regular succession, it is correct—with certain exceptions to be noted—where Ahau is used as the initial day in the count, but will not apply when any other day is selected as the initial date. It is erroneous in counting 13 of the cycles or the 5th order of units to the next higher order, and in beginning the numbering of the so-called periods with 73, 13, and 20. His tables of years are also erroneous in the latter respect.

It is apparent to anyone at all acquainted with the Mayan time and numeral systems that, having a continuous series of days written out in regular order and of sufficient length, with the day numbers and month numbers attached, we may start at any point and count off the numbers given in the ahau, katun, and cycle periods, and we will have precisely what is given in Goodman's "Archaic Chronological Calendar," except that we may have some other initial day than Ahau. If it should be Kan it would at some point correspond exactly with the series of the Dresden codex which have been referred to; if Ahau, then the periods would agree with those of the inscriptions and some of those in the Dresden codex. Now, it is evident that in counting off a number in the next higher group above the so-called cycle, if we count off the latter periods by 20, instead of 13, the succession would be as regular as in the other case, there being nothing whatever in the system requiring or even suggesting 13. Hence we might take Goodman's tables, if more extended, and making 4 Ahau 8 Cumhu our starting point, count forward or backward by steps of 20 cycles each, and thus find the correct initial days of the great cycles as we have shown above. With the tables given in his work we can only count forward from the beginning of his 54th great cycle to the 7th cycle of the 55th great cycle as he has numbered them, showing that 10 Ahau 13 Yaxkin is the beginning day of the next great cycle, counting 20 cycles to the great cycle, which I have shown to be the correct method.

I shall not discuss Goodman's theory of the number values of the day and month symbols, as there does not appear to have been any use made of them as numerals.

Let us turn again to the order in which the numbers of the ahaus follow one another, to wit: 13, 9, 5, 1, 10, 6, 2, 11, 7, 3, 12, 8, 4, 13, etc. This has been fully discussed in one light in this paper, but the object at present is to view it in another light and with special reference to Goodman's theory in regard to it. That has also been noticed to some extent in my previous paper, but there are some points omitted in that discussion to which it is desirable to call attention. I quote in full Goodman's statement of his discovery of the order of succession:

Ymix is the day following Ahau; hence, I reasoned to myself, if a period begin with the former it must terminate with the latter; moreover, 1 succeeding 13 in the day count, if 1 Ymix begin a period 13 Ahau must end it; and, further, this period being composed of 13 lesser ones of 20 years each, it is at a distance of 260 years apart in the annual calendar that I must look for a corresponding 1 Ymix and 13 Ahau, recollecting that I need not expect to find them falling on any fixed date. But, as the order of the 13 subdivisions is given, with the terminal Ahau numbers, it is not necessary to attempt so extended a research, and prudence dictates that I keep my experiments within the narrowest possible limits to guard against mistake. I will, therefore, at the start proceed only to the end of the first 20-year period, or katun, and look for 11 Ahau. The trial is made. It proves abortive, as I anticipated. The Ahau number at the end of 20 years is 7 instead of 11. The desired 11 Ahau is 5 months away to the left. It is the same old

story of failure over again. But wait a minute! Five months are equivalent to 100 days. To divide by 20 would take just 5 days from each of the 20 years of the katun. Years? What if they were not years at all that Landa was talking about, but only periods of 360 days? They may be the ahaus. Let me hasten to find out how the numbers will run in a division of this possible Katun into 20 such periods. Here it is: 9, 5, 1, 10, 6, 2, 11, 7, 3, 12, 8, 4, 13, 9, 5, 1, 10, 6, 2, 11. Ah, this is significant! That paragraph of Perez, what are its exact words? "The Indians of Yucatan had yet another species of cycle, but as the method followed by them in using it can not be found, nor any example by which an idea of its nature might be imagined, I shall only copy what is literally said of it in a manuscript, viz: 'There was another number which they called *ua katun*, and which served them as a key to find the katuns. According to the order of its march it falls on the days of the *uayeb yaab* and revolves to the end of certain years: katunes 13, 9, 5, 1, 10, 6, 2, 11, 7, 3, 12, 8, 4.'" Poor Don Pio! To have the pearl in his grasp and be unaware of its pricelessness, like so many others. But I must not exult too much yet. The succession of the katuns, reckoned according to this principle, is yet to be ascertained before my fancied discovery can be established by a crucial test. I score the ahaus off in the foregoing order, and, sure enough, the 20ths give the desired result, 11, 9, 7, 5, 3, 1, 12, 10, 8, 6, 4, 2, 13. Eureka! The perturbed spirit of the Maya calendar, which has endeavored so long to impart its message to the world, may rest at last.

That taking the day numbers of the first days of the ahaus in a katun will give the order of succession mentioned is certainly true, as we have shown, but the question to be discussed here relates to the statement of the authority quoted by Perez. According to this statement as given by Goodman, "There was another number which they called *ua katun*, and which served them as a key to find the katuns. According to the order of its march it falls on the days of the *uayeb yaab*, and revolves to the end of certain years; katunes 13, 9, 5, 1, 10, 6, 2, 11, 7, 3, 12, 8, 4."

It will be best, however, to give Perez's exact words as found in the appendix to Brasseur's edition of Landa's "De las Cosas," page 418:

"Habia otro número que llamaban *Ua Katun* el que les servia como llava para acertar y hallar los katunes, y segun el orden de sus movimientos cae á los dos dias del *Uayeb haab* y dá su vuelta al cabo de algunos años: Katunes 13, 9, 5, 1, 10, 6, 2, 11, 7, 3, 12, 8, 4."

Brasseur's translation is as follows:

"Ils avaient un autre chiffre qu'ils appelaient *Ua Katun*, qui leur servait comme de clef, pour ajuster et trouver les katun et suivant l'ordre de ses mouvements, il tombeaux deux jours du *Uayabhaab* et retourne à la fin de quelques années: Katun 13, 9, 5, 1, 10, 6, 2, 11, 7, 3, 12, 8, 4."

A closer translation than that by Goodman, which omits one important word, may be given as follows:

They have another number which they called *ua katun*, which served them as a key to regulate and find the katuns, and according to the order of its movements falls on the two days of the *uayeb haab* and returns at the end of certain years; katuns 13, etc.

The important word omitted by Goodman and which is usually omitted in English translations is the "two." Brasseur's translation

contains it, and Perez recognizes it by his (erroneous) reference on the same page as the passage quoted, the "second" intercalary day. I called special attention to this important word in my "Study of the Manuscript Troano," page 55.

Now, it is certain that the unknown author of this passage was somewhat familiar with the Maya time system, otherwise he could not have hit upon this order of numbers which is found in at least three different relations in the system; and it is also certain that his reference is to true Mayan years (as is shown by the reference to the uayeb haab, or five intercalated days), and can not be made to apply to Goodman's ahaus.

As the term "years" in the passage quoted can have no other possible meaning than that of 365 days, the question arises, what is meant by the term "katun" as therein used? That it could not be Goodman's katun of 7,200 days, or 20 ahaus of 360 days each (which Seler also claims to have discovered), is evident. Although we may not be able to demonstrate what is meant by the term in this connection, we can show where and how this order of succession occurs, using the last of the intercalated days. As the number of the day with which the year ends is the same as that with which it begins, the order will be precisely the same as that in which the years are numbered. If the calendar of the inscriptions and the Dresden codex is used, whose dominical days are Akbal, Lamat, Ben, and Ezanab, the terminal days will be Manik, Eb, Caban, and Ik, and their numbers in the successive years will be as shown in the following table, which extends through the cycle of 52 years, after and before which the same series will be repeated:

Manik	Eb	Caban	Ik
1	2	3	4
5	6	7	8
9	10	11	12
13	1	2	3
4	5	6	7
8	9	10	11
12	13	1	2
3	4	5	6
7	8	9	10
11	12	13	1
2	3	4	5
6	7	8	9
10	11	12	13

Beginning at the bottom and running up the right-hand column, we find precisely the order of succession given in the quotation, to wit, 13, 9, 5, 1, 10, 6, etc. Precisely the same order will be found by running up either of the other columns. Each step, it is true, covers four years, but it forms a basis for easy and ready counting; moreover, the quotation says, "returns at the end of certain years." It does

not say the "numbers" which so return are katuns, but that they "served as a key to find the katuns," clearly distinguishing between the "katuns" and "certain years." There is nothing, therefore, in the quotation which implies that the numbers in the series 13, 9, 5, etc., were the numbers of the katuns, nor is there any mention therein of the numbers of the katuns or of the number of years constituting a katun. It is to Landa that we must go for information on the latter point. According to his statement, which has been oft repeated, the Mayas counted their ages by 20 years,^a but he says nothing in reference to the order of numbering.^b

As the periods referred to are unquestionably years, the katuns must be periods of years; and writers who have so contended are correct in this respect, and 20 years is the number assigned to a katun by all the early authorities, whether right or wrong.

The direction of counting, it is true, is backward, but, as Goodman states, the reference among the Mayas is generally to past time, and the example Landa gives of counting time, in connection with the passage referred to, relates to what had passed. He says an elderly man of whom he had spoken could easily count back 300 years by means of the katuns or ages. This author, if I rightly understand his language, indicates that they had a still higher count of 13×20 years. His language is as follows:

No solo tenían los indios cuenta en el año y meses, como queda dicho, y señalado atrás pero tenían cierto modo de contar los tiempos y sus cosas por edades, las quales hazian de veynte en veynte años, contando XIII veyntes con una de las XX letras de los meses que llaman *Ahau*, sin orden sino retruecanados como parecieran en la siguiente raya redonda; llaman les a estos en su lengua *Katunes*.^a

Thirteen times 20 is 260, or five cycles of 52 years each, the same number of years that there are days in their so-called sacred year. Possibly, however, he may refer here to the 260-day period.

When we free our minds entirely from any thought that *ahaus*, katuns, etc., represent or have any relation to time periods, and look upon them merely as numbers, just as we think of tens, hundreds, etc., the difficulties raised by Goodman's theory of a Maya "chronological calendar" vanish. The Mayas of one section, for some historical, traditional, or mythological reason, selected a particular initial date for their era, and, as a usual thing, counted long periods from it, and in doing so used numbers in accordance with their numeral system, and represented these in their inscriptions by certain symbols. This is all of Goodman's supposed wonderful chronological system—this and nothing more.

It would have been much better if he had used the real Mayan numeral terms as they stand (as Dr Brinton has suggested), or in a

^a Landa, *De Las Cosas*, p. 312.

^b It will doubtless be recalled that in the "Study of the Manuscript Troano" I contended that the *ahaus* or katuns consisted of 24 years, basing my conclusion on the order given above; but a more careful study of the passage quoted above from Perez does not necessarily indicate that these periods were numbered according to the order given.

modified form, to indicate the variation of time numeration from the regular vigesimal system, thus:

20 units	= 1 kal in place of chuen.
18 kal	= 1 bak in place of ahau.
20 bak	= 1 pic in place of katun.
20 pic	= 1 calab in place of cycle.
20 calab	= 1 kinchil in place of great cycle.
20 kinchil	= 1 ahau in place of grand era.

It is true that above the kal the numbers would vary from the true vigesimal count in consequence of counting but 18 instead of 20 kal to the next higher order. This, however, might have been shown by prefixing "minor," thus, "minor bak," "minor pic," etc., but no real confusion would have resulted from using the simple names as Brinton has suggested. Seler suggests "ninal" in place of chuen; "tun" in place of ahau, but retains "katun" as applied by Goodman.

THE CAKCHIQUEL CALENDAR

If the "Annals of the Cakchiquels," written or supposed to have been written soon after the Spanish conquest by a member of the Xahila family, are to be trusted in regard to the Cakchiquel calendar system, this system was peculiar, differing in some important respects from that of the Mayas, which has been described in the preceding part of this paper. All that is known in regard to its peculiar features is found in these Annals, and must be gathered from incidental mention of dates. In order to place the data before the reader, I quote the more important of these mentions from the translation by Dr Brinton in the Library of Aboriginal American Literature, VI, "The Annals of the Cakchiquels," 1885.

As a noted revolt, described as the "revolt at Iximche," is selected by the author of the Annals as the era from which to reckon all subsequent events, we begin the quotations with the passages referring to and fixing the date of this event.

(1) The day of the revolt was appointed by this chief, Cay Hunahpu, and on this day, 11th Ah, the revolt broke out [page 157].

(2) Thirty-one days after the revolt, as the Quiches desired to destroy those of Tibaqoy, these Tukurches removed to Chiavar and put to death the Quiches, who yielded in a battle at a place named Yaxontzui, on the day 9th Caok [page 159].

(3) On the 36th day after the revolt Cinahitoh perished . . . on the day 11th Can [ibid.].

(4) One year less ten days after the revolt was hanged the chief orator Ahmox-nay on the day 11th Akbal [ibid.].

(5) The day 8 Ah was one year after the Revolt [page 161].

(6) The day 5 Ah was two years after the Revolt [ibid.].

(7) The day 2 Ah was three years after the Revolt [ibid.].

(8) The day 12 Ah completed the fourth year after the Revolt [ibid.].

(9) The 9 Ah completed the fifth year after the Revolt [page 163].

(10) The 6 Ah completed the sixth year after the Revolt [ibid.].

(11) On the 3 Ah there were seven years from the Revolt [ibid.].

(12) In the eighth year after the revolt, the Tzutuhils were defeated by those of Xeynup and Xepalica; they were slaughtered, Zakbin and Ahmak having perished in the action on the day 13 Ahmak [ibid.].

(13) On the day 13 Ah there were eight years from the revolt [ibid.].

(14) On 10 Ah there were nine years from the revolt [ibid.].

(15) Twelve days were lacking to complete the tenth year after the revolt . . . the day 8 Imox [ibid.].

(16) The day 7 Ah completed the tenth year after the Revolt [ibid.].

(17) On 4 Ah there were eleven years after the Revolt [ibid.].

(18) On 1 Ah there were twelve years [ibid.].

(19) On 11 Ah there were thirteen years after the Revolt [ibid.].

(20) The day 8 Ah completed the 14th year after the Revolt [page 165].

(21) The day 5 Ah completed the 15th year after the Revolt [ibid.].

(22) The day 2 Ah completed the 16th year after the Revolt [ibid.].

(23) The day 12 Ah completed the 17th year after the Revolt [page 167].

(24) The day 9 Ah completed the 18th year after the Revolt [ibid.].

(25) On the day 3 Caok the doves passed over the city of Iximche. . . . One hundred days after the doves had been seen the locusts came . . . on the day 2 Yg [ibid.].

(26) The day 8 [6?] Ah completed the 19th year after the Revolt [ibid.].

(27) The day 3 Ah completed one cycle [page 169].

(28) With the day 13 Ah another year was completed [ibid.].

(29) A second year was completed on the day 10 Ah, after the Revolt [ibid.].

(30) On the day 7 Ah was completed the third year of the second cycle after the Revolt [ibid.].

So far the dates given are in regular succession as found in the Annals; the others given are only those which are considered important.

(31) On the day 14 [12?] Camey died the King Hunyg [page 171]. . . . A hundred days after the death of the kings Hunyg and Lahuh Noh, there were elected as kings Cahi Imox and Belehe Qat, on the day 1 Can [page 173].

(32) Twenty days after the chiefs began to rule there was an insurrection . . . on the day 10 Queh [page 175].

(33) We married your mother. O my children, one year after the death of your grandfather [Hunyg]. We took her to wife on the day 12 Toh [pages 175-177].

(34) On the day 5 Ah was the eighth year of the first [second] cycle. It was during this year [meaning the year following?] that the Castilians arrived. . . . On the day 1 Ganal the Quiches were destroyed by the Castilians. . . . On the day 4 Qat three chiefs, the king and the next in rank, were burned alive by Tunatiuh [page 177].

(35) It was on the day 1 Hunahpu when the Castilians arrived at Iximche with their chief, Tunatiuh. . . . Only five days after, Tunatiuh went forth from the capital. Then the Tzutuhils were conquered by the Castilians. It was the day 7 Camey [page 179].

(36) Twenty-five days afterwards Tunatiuh went forth from the capital to Cuzcatan . . . On the day 2 Queh Atacat was slain . . . On the day 10 Hunahpu he [Tunatiuh] returned from Cuzcatan. He had been absent only 40 days [page 181].

(37) Our city [Iximche] was abandoned on the day 7 Amak . . . Ten days after we had left the city, war was begun by Tunatiuh . . . on the day 4 Camey . . . One hundred and eighty days after the desertion of the city was completed the ninth year (of the second cycle). On the day 2 Ah was completed the 29th year after the Revolt [page 183].

(38) There were lacking 120 days to complete two years since we had abandoned the capital when Tunatiuh came there in order to set fire to the city. On the day 4 Camey, two years less six months after the beginning of the war, he set fire to the capital and returned [page 185].

(39) On the day 12 Ah was completed the 30th year after the Revolt [ibid.].

(40) On the day 9 Ah was completed the 31st year after the Revolt [ibid.].

(41) In the course of the following year . . . Chiixot was abandoned. . . . Three hundred days after Chiixot was taken began the payment of tribute . . . on the day 6 Tzi [pages 185-187].

(42) It was two years less 120 days after the beginning of the tribute when died the chief Ahtun cuc Tihax . . . on the day 6 Akbal. . . . On the day 3 Ah was completed the 33d year [page 187].

(43) For 86 days these chiefs had hid in the woods. . . . On the day 7 Ahmak the chiefs decided to come forth. . . . On the day 13 Ah was completed the 36th [34th] year after the Revolt [page 187].

(44) On the 10th Ah was completed the 35th year after the Revolt. Forty days were lacking to complete three years from the date of the submission of the kings when Belehe Qat died . . . on the 7th Queh [page 188].

(45) On the 8th Ah was completed the 40th year after the revolt. On the 5th Ah was completed the first year of the third cycle [page 189].

(46) It was on the day 11 Ahmak that he [Tunatiuh] killed the Ah-tzib. On the day 2 Ah was completed the second year of the third cycle. One hundred and twenty days after the death of Ahtzib and of the return of Tunatiuh, the prince Mantunalo departed . . . Two hundred and sixty days after his return Tunatiuh hanged the king Ahpozotzil Cahi Imox. on the day 13 Ganel [pages 189-190].

(47) The day 12 Ah completed the third year of the third cycle. Two hundred and eighty days after the execution of the king Ahpozotzil he hanged Chuvy Tziquinu . . . on the day 4 Can [page 190].

(48) On the day 9 Ah was completed the fourth year of the third cycle after the revolt. . . . On the day 2 Tihax . . . the wife of Tunatiuh was drowned. One hundred and sixty days after this disaster there arrived our fathers of St. Dominic . . . on the day 12 Batz [page 190].

(49) On the day 8 Ah was completed the 13th year of the third cycle. . . . Ahtzil Juan Perez . . . died on the day 12 Tihax. Eighty days after . . . there was an eruption of the mountain Chigag . . . on the day 9 Ah . . . On the day 12 Ah was completed the 16th year of the third cycle [page 192].

(50) Died the chief Don Francisco Ahpozotzil . . . on the day 1 Can, a Monday, the 14th day of the month October [page 193].

(51) On the day 6 Ah was completed the 18th year of the third cycle. . . . In the 13th month the day of Sanctiago occurred on the day 1 Tziquin. . . . On that day was inaugurated . . . the Emperor Don Peliphe. . . . The day St. Francis [was] the day 7 Camey [pages 193-194].

(52) On the day 3 Ah was completed the 19th year of the third cycle after the revolt. The Alcaldes in the year 1557 were . . . The day 5 Ey [was] 20 days before the close of the third cycle. . . . On the day 13 Ah was completed the third cycle . . . in the year 1558 [page 194].

The foregoing notes and quotations contain, it is believed, all the data found in the "Annals" throwing any light on the Cakchiquel calendar. But in order that the reader, who may not have the works relating to this calendar at hand, may be furnished with the data necessary to follow me in my discussion, I introduce here a list of the days of this calendar in the order usually given, with those of the Maya calendar placed beside them in corresponding order.

Days of the Cakchiquel and Maya Calendars

	Cakchiquel days	Maya days		Cakchiquel days	Maya days
1	Imox	Imix	11	Batz	Chuen
2	Ig or Yg	Ik	12	Ee	Eb
3	Akbal	Akbal	13	Ah	Ben
4	Kat	Kan	14	Yiz	Ix
5	Can	Chicchan	15	Tziquin	Men
6	Camey	Cimi	16	Ahmak	Cib
7	Queh	Manik	17	Noh	Caban
8	Kanel	Lamat	18	Tihax	Ezanab
9	Toh	Muluc	19	Caok	Canac
10	Tzii	Oc	20	Hunahpu	Ahau

As the author of the Annals ends the year with the day Ah, it must have begun with Yiz, if there was no arbitrary change in the succession of days. The following condensed calendar is therefore constructed on this basis as a means of counting time:

Cakchiquel Calendar

1 Yiz	1	8	2	9	3	10	4	11	5	12	6	13	7
2 Tziquin	2	9	3	10	4	11	5	12	6	13	7	1	8
3 Ahmak	3	10	4	11	5	12	6	13	7	1	8	2	9
4 Noh	4	11	5	12	6	13	7	1	8	2	9	3	10
5 Tihax	5	12	6	13	7	1	8	2	9	3	10	4	11
6 Caok	6	13	7	1	8	2	9	3	10	4	11	5	12
7 Hunahpu	7	1	8	2	9	3	10	4	11	5	12	6	13
8 Imox	8	2	9	3	10	4	11	5	12	6	13	7	1
9 Ik	9	3	10	4	11	5	12	6	13	7	1	8	2
10 Akbal	10	4	11	5	12	6	13	7	1	8	2	9	3
11 Kat	11	5	12	6	13	7	1	8	2	9	3	10	4
12 Can	12	6	13	7	1	8	2	9	3	10	4	11	5
13 Camey	13	7	1	8	2	9	3	10	4	11	5	12	6
14 Queh	1	8	2	9	3	10	4	11	5	12	6	13	7
15 Kanel	2	9	3	10	4	11	5	12	6	13	7	1	8
16 Toh	3	10	4	11	5	12	6	13	7	1	8	2	9
17 Tzii	4	11	5	12	6	13	7	1	8	2	9	3	10
18 Batz	5	12	6	13	7	1	8	2	9	3	10	4	11
19 Ee	6	13	7	1	8	2	9	3	10	4	11	5	12
20 Ah	7	1	8	2	9	3	10	4	11	5	12	6	13

In using this to count forward, we count on to the end of the right-hand column and then go back to the left-hand column. To count backward, the direction is reversed.

It will be observed from the quotations given that the years all end with the day Ah, that the numbering of the days is by 1 to 13 as usual, and that the terminal Ahs of the years succeed one another in the following order: 11 Ah, 8 Ah, 5 Ah, etc., giving the descending series 11, 8, 5, 2, 12, 9, 6, 3, 13, 10, 7, 4, 1, 11, 8, etc., the number of any given year being 3 less than that of the one which preceded.

It is apparent, therefore, that the year could not have consisted of

365 days, that is, of 18 months of 20 days each and 5 added days, for even the supposition that these added days were neither numbered nor counted does not give the order found in the Annals. Nor will Goodman's supposition that they counted 366 days to the year give this succession, though he counts the system alluded to in the Annals as distinct from the Cakchiquel Annual Calendar. Brinton says:

The calendars in use were of two different kinds, the one called *qhol kih*, literally "the valuer or appraiser of days," which was employed exclusively for astrological and divining purposes, to decide on which were lucky and unlucky days, and *may kih*, "the revolution or recurrence of days," which was for chronological purposes.^a

I find no other explanation of a calendar which would end in the manner mentioned in the Annals, than a year of 20 months of 20 days each, or 400 days, the days being numbered in the usual Mayan method of 1 to 13. Seler^b gives this explanation and Goodman also adopts it for their chronological year. That if we count this number of months to the year the different years will end on the same day is evident, and that the day numbers will follow one another in the order mentioned above can be seen by reference to the above condensed calendar. If we count 20 months, the year beginning with 1 Yiz will end with 10 Ah, and the next year will begin with 11 Yiz; or if we commence with the column headed 11, and count 20 months, the year will end with 7 Ah, and the next year will begin with 8 Yiz; if we commence with the column headed 8, and count 20 months, the year will end with 4 Ah, etc. This appears to be the only explanation of this singular calendar, if we suppose the annalist to be correct in his statements as to the dates on which the years ended.

As proof that the annalist counted 400 days to the year we have the following evidence from the above quotations: By number 1, we learn that the Revolt, which he takes as the beginning of his era, took place on 11 Ah; by number 5 we see that the first year of the Revolt ended on 8 Ah; in number 4 it is stated that "One year less ten days after the revolt was hanged the chief orator Ahmoxnoy, on the day 11 Akbal." The day 11 Akbal will occur twice only in the ordinary year of 365 days, and twice only in the year of 400 days. As the Revolt occurred on 11 Ah, the first year thereafter must have begun with the day 12 Yiz. The day 11 Akbal would occur first at the end of 6 months and 10 days—or 130 days. That 10 days added to this could not have completed the year will be conceded. The next occurrence of 11 Akbal would be at the end of 19 months and 10 days, or 390 days, 10 days more reaching the day 8 Ah, the end of the first year. Although neither 140 nor 400 days correspond with any natural phenomena it is safe to assume that 400 days was the period the annalist referred to and not 140 days.

^a Annals of the Cakchiquels, Philadelphia, 1885, p. 31.

^b Transactions Berlin Anthropological Society, June, 1889.

In number 15 it is stated that 12 days were lacking to complete the tenth year after the Revolt, etc., on the day 8 Imox; and in number 16 that the day 7 Ah completed the 10th year. As it is stated in number 14 that 10 Ah was the end of the 9th year after the Revolt, 8 Imox would occur 128 and 388 days thereafter. Counting 12 days from the latter brings us to 7 Ah and gives 400 as the number of days in the year. This result must be accepted, or we must decide that the year consisted of only 140 days, which is unreasonable. In number 24 it is stated that 9 Ah completed the 18th year after the Revolt, and in number 26 that 8 (?) Ah completed the 19th year (that this should be 6 Ah is evident, as 9 Ah precedes and 3 Ah (number 27) follows it). In number 25, which relates to the 19th year, it is stated that on the day 3 Caok the doves passed over the city of Iximehe; and that 100 days after the doves had been seen the locusts came, on the day 2 Yg (or Ik). Now, the first occurrence of 3 Caok in the 19th year after the Revolt, that is, the year following 9 Ah (the year beginning with 10 Yiz), is 2 months and 6 days after the commencement of the year. One hundred days more bring us to 12 Caok, the 6th day of the 8th month, or 7 months and 6 days from the commencement of the year. This is not the day given, but counting 4 days more we reach 2 Yg or Ik, the day named. As 100 is a round number, the 104 may be assumed as correct. As this, even if the number be limited to 100; gives more than 140 days in this year we have evidence that a year of 400 days was counted by the annalist.

In numbers 31 and 32, and two or three items not given in the quotations, we have conclusive evidence that 400 days were counted to the year by the Annals. They are as follows:

1 Ah completed the 5th year of the second cycle (25th year) after the revolt (page 171).

In the following year, ending on 11 Ah, Hunyng died on 12 Camey. (ibid. Brinton's translation gives 14 Camey, but this is wrong, as there could be no 14 Camey; the original says 12).

100 days after was the day 1 Can (page 173).

20 days later was 10 Queh (page 175).

The day 11 Imox follows in this year (ibid.).

The day 9 Batz occurs after this same year (ibid.).

The year ends on 11 Ah (ibid.).

As the preceding year ended on 1 Ah, this year began with 2 Yiz, and 12 Camey would be the 13th day of the 12th month. One hundred and twenty days more (or exactly 119) and not 100, as the annalist says, would reach 1 Can, the 12th day of the 16th month; 22 days more would reach 10 Queh, the 14th day of the 17th month. The day 11 Imox would be the 8th day of the 18th month, and 9 Batz the 18th day of the 20th month, just two days before 11 Ah, the close of the year.

In the year following 5 Ah (number 34), that is to say, the year beginning with 6 Yiz, the following events, with dates, are mentioned (numbers 35, 36, and 37):

- On 1 Ganel the Quiches were destroyed.
- On 4 Quat the chiefs were burned by Tunatiuh (Alvarado).
- On 1 Hunahpu the Spaniards reached Iximche.
- Five days after, Tunatiuh left the capital; then the Tzutuhils were conquered on 7 Camey.
- Twenty-five days afterward Tunatiuh went forth to Cuzcatan and slew Atacat on the day 2 Queh. On 10 Hunahpu he returned, having been absent 40 days.
- IXimche was abandoned on 7 Amak.
- Ten days after, on 4 Camey, Tunatiuh began war.
- One hundred and eighty days after the city was abandoned the 29th year after the revolt was completed on 2 Ah.

The day 1 Ganel (or Kanel) was the 15th day of the 2d month; 4 Quat (or Kat) was the 11th day of the 3d month; 1 Hunahpu the 7th day of the 5th month. "Five days after" should be 6 to reach 7 Camey, the 13th day of the 5th month. "Twenty-five days afterwards" (after 7 Camey) should be 21 to reach 2 Queh, 14th day of the 6th month, and 10 Hunahpu is the 7th day of the 10th month, hence the 40 days, if counted from 2 Queh, would be wrong. The 7 Amak would be the 3d day of the 12th month, and 4 Camey the 13th day of the 12th month. From 7 Amak, the day IXimche was abandoned, to 2 Ah, the end of the year (still counting 400 days), was only 177, the round number given by the annalist being 180.

These items of evidence are sufficient to prove, beyond any reasonable doubt, that the annalist counted 400 days to the year, and that the years of the calendar which he used always began with the day Yiz. The beginning and ending days of the years would therefore be as follows if we start with 12 Yiz, the first year after the Revolt:

Beginning day	Ending day	Beginning day	Ending day
Yiz	Ah	Yiz	Ah
12	8	1	10
9	5	11	7
6	2	8	4
3	12	5	1
13	9	2	11
10	6	12	8
7	3	and so on.	
4	13		

The next question that arises, and the one of most importance in the discussion, is this: Was the writer justified in indicating that such a calendar as this was in use among the Cakchiquels at the coming of the Spaniards? On this point we must judge chiefly by internal evidence. As what is known in regard to the history of the manuscript is given by Brinton in his introduction, it is unnecessary to

repeat it here. The writer claims to have been a descendant (grandson) of the ruling chief of the Cakchiquels at the time of the arrival of the Spaniards, and was then a youth of probably some 16 or 18 years. Judging by his method of giving dates, he seems to have been familiar with a calendar then in use. Moreover his station would indicate that he had been trained in the study of the chronology of his tribe. I am, therefore, inclined to accept as substantially correct his statements so far as they bear on the calendar system, though the traditional portion may be of very little or no historical value. If this view be accepted, it may throw some light on one troublesome feature of the Maya calendar—the introduction of the multiple 18 in counting the months. Why the change from the lunar period to a period of twenty days to the month was made, is not easily accounted for, except on the supposition that, having decided for ceremonial or other reason to abandon the lunar count, it was natural to follow the vigesimal system, hence the 20 days to the month, 20 months to the year, and 20 years to the cycle or *ahau*. The necessity, however, for some adjustment between the ceremonial and true year brought about at length the adoption of 18 months and 5 added days, and the substitution of 18 in place of 20 in time numeration. It seems possible, if the annalist be correct in his time count, that the peculiar native calendar may have come into use somewhat in this way.

I can find no grounds whatever for Goodman's assertion that the calendar year of the Cakchiquels consisted of 366 days. They may be in a historical mention which I have failed to find, but by no possible means can this year be made to agree with the calendar of the *Annals* without assuming an arbitrary break in the succession of the days at the end of each year.

MAYA METHOD OF CALCULATION

As I have, in my paper on the "Mexican and Central American Numeral Systems,"^a brought up the question, How did the Maya priests actually perform their calculations relating to time series, some of them reaching into millions? I propose to discuss the subject somewhat more at length here. As was stated in that paper, these calculations sometimes required changing series of days, *chuens*, *ahaus*, *katuns*, cycles, and even great cycles (or more correctly units of the 1st, 2d, 3d, 4th, 5th, and even the 6th order in the vigesimal system), to years, months, and days, reaching from one given date to another. As such calculations could not possibly have been made mentally, the authors of the inscriptions and codices must have had some method of "ciphering," to use a school-boy term, or of making the calculation by marking on some object. As was stated in the paper referred to, the only allusion to the subject by an early authority, so far as is known, is the statement by Landa that they performed them "on the ground or some flat thing."

^aNineteenth Annual Report of the Bureau of American Ethnology.

As the different kinds of symbols used by the Mayas to express numbers have been referred to, I assume that the reader is familiar with them. That direct multiplication and division would seem to be impossible with their characters where both numbers included units above the first order, or, at most, first and second orders, will be admitted. The suggestion by Professor McGee (referred to in the paper on numeral systems) that these operations might have been performed by addition and subtraction seems to be the key to the problem, as I shall attempt to show.

That the Mayas could add and subtract numbers expressed in the ordinary numeral symbols (dots and short lines) is known from hundreds of examples in the Dresden codex; and that for these characters they could readily substitute equivalent symbols of other forms in use is evident. Take, for illustration, part of a series from plate XXIV, Dresden codex (see plate LXXXII), which has been reversed, so that it is to be taken from left to right instead of from right to left, as in the original. The date below each column is written out, and instead of the naught symbol a cipher (0) is inserted:

(1)	(2)	(3)	(4)	(5)	(6)
$\begin{array}{c} \cdot \cdot \cdot \\ \hline \cdot \cdot \end{array}$	$\begin{array}{c} \cdot \\ \hline \cdot \cdot \cdot \cdot \end{array}$	$\begin{array}{c} \cdot \\ \hline \cdot \cdot \cdot \cdot \end{array}$	$\begin{array}{c} \cdot \\ \hline \cdot \cdot \end{array}$	$\begin{array}{c} \cdot \cdot \\ \hline 0 \end{array}$	$\begin{array}{c} \cdot \cdot \\ \hline \cdot \cdot \cdot \end{array}$
$\begin{array}{c} \cdot \cdot \\ \hline 0 \end{array}$	$\begin{array}{c} \cdot \cdot \cdot \cdot \\ \hline 0 \end{array}$	$\begin{array}{c} \cdot \\ \hline 0 \end{array}$	$\begin{array}{c} \cdot \cdot \cdot \\ \hline 0 \end{array}$	$\begin{array}{c} \hline 0 \end{array}$	$\begin{array}{c} \cdot \cdot \\ \hline 0 \end{array}$
9 Ahau	4 Ahau	12 Ahau	7 Ahau	2 Ahau	10 Ahau

If we write these in Arabic figures, preserving the relative positions and omitting the dates, as those given can be referred to, the series will be as follows:

		1	1	2	2
8	16	4	12	0	8
2	4	6	5 (8)	10	12
0	0	0	0	0	0

Doubling the first column (8-2-0) we get 16-4-0; adding again 8-2-0, we get 1-4-6-0; adding again 8-2-0, we get 1-12-8-0 (the 5 in this column should be 8, as by adding 8-2-0 to it as thus corrected we get 2-0-10-0, the 5th column, etc.).

If we write the equivalent of each number in days, maintaining the same relative positions, and give the sum of each column below (making the correction noted), the result will be as follows:

		7,200	7,200	14,400	14,400
2,880	5,760	1,440	4,320	0	2,880
40	80	120	160	200	240
0	0	0	0	0	0
<hr/> 2,920	<hr/> 5,840	<hr/> 8,760	<hr/> 11,680	<hr/> 14,600	<hr/> 17,520

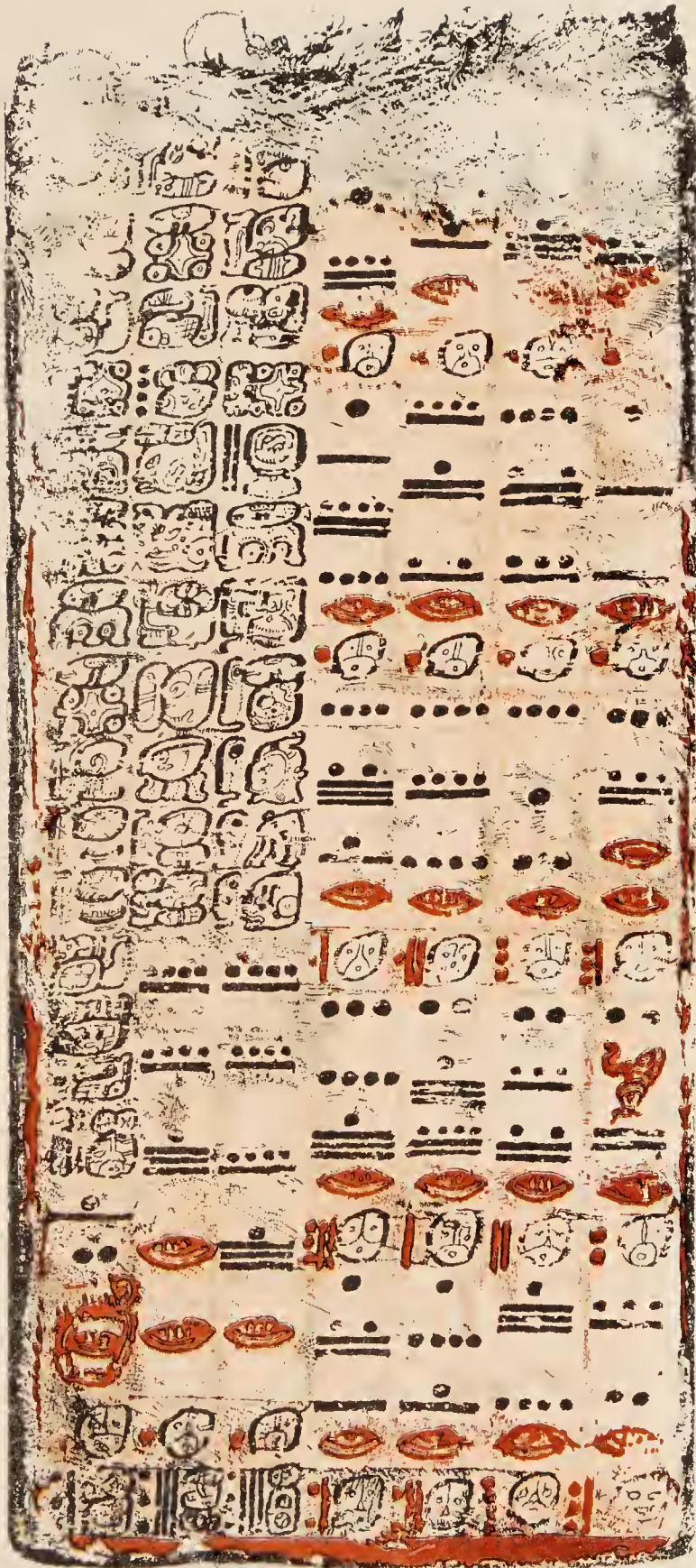


PLATE XXIV OF THE DRESDEN CODEX

This represents a calendar round or cycle of 52 years (18,980 days), the given date (3 Chicchan 18 Yax) returning at the end of this period. For convenience we make the series ascending toward the right, and after a few additions double the columns to make progress more rapid. The usual rule is followed; the counter is given as the first column; the columns are numbered as a means of reference.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
			
.	—	.	—
..	—	..	—
...	—	0
0	0	0	0	0	0	0	0	0

The counter or first column is added to itself, or doubled, to form the second; the first is added to the second to form the 3rd; the first to the 3rd to form the 4th; but to hasten the process they are doubled successively from this point to the 8th. As doubling the 8th would raise the number above that contemplated, only the number necessary to give the 9 cycles is added, but this must be the counter (first column) or a multiple of it. The required number is found in the 5th column; this added to the 8th gives the 9th. The sum of the 9th column, if no mistake has been made, should, counting back from 3 Chicchan 18 Yax, bring us again to the same date.

As a count of a cycle of 52 years (our first column) includes the entire series of days and day numbers known to the system, 4 Ahau 8 Cumhu must be contained therein, and the count to it from the date reached must be less than the amount represented by our first column. Our next step, therefore, is to ascertain the lapse of time from our last date (3 Chicchan 18 Yax) to the next preceding occurrence (as we are counting backward) of 4 Ahau 8 Cumhu. Just what method the authors of the inscriptions and codices employed for this purpose, as there are more than one, I can not state positively, but give one which I am satisfied they could follow.

They could readily ascertain, as is shown by almost every numeral series with a date, that the day 3 Chicchan 18 Yax fell in the year 1 Lamat, and 4 Ahau 8 Cumhu in the year 8 Ben; hence they could easily tell, by counting on their fingers or making marks, that from the latter to the former is 18 years and the fractions of the two years—

the fraction in the former being 198 days or $\frac{198}{360}$ and in the latter 17 or $\frac{17}{360}$. As the year is represented by $\frac{1}{0}$ the 18 years would be $\frac{18}{0}$.

By adding to this the $\begin{smallmatrix} \dots \\ \dots \\ \hline \hline \end{smallmatrix}$ and $\begin{smallmatrix} \dots \\ \dots \\ \hline \hline \end{smallmatrix}$, or together $\begin{smallmatrix} \dots \\ \dots \\ \hline \hline \end{smallmatrix}$, we obtain the sum represented by $\begin{smallmatrix} \dots \\ \dots \\ \hline \hline \end{smallmatrix}$. Add this to the 9th column, the

result is the following number, to wit: $\begin{smallmatrix} \dots \\ \dots \\ \hline \hline \end{smallmatrix}$ or 9 cycles, 10 katuns,

14 ahaus, 15 chuens, 5 days.

If no mistake has been made, this number, if we count back from 3 Chicchan 18 Yax, year 1 Lamat, should bring us to 4 Ahau 8 Cumhu, the first day of Goodman's so-called 54th great cycle. Trial proves it to be correct, thus:

	Days
9 cycles	1,296,000
10 katuns	72,000
14 ahaus	5,040
15 chuens	300
5 days	5
Total	1,373,345
Subtract 72 calendar rounds	1,366,560
Remainder	6,785

Counting back this number of days from 3 Chicchan 18 Yax brings us to 4 Ahau 8 Cumhu. Turning to Goodman's "Chronological Calendar," 54th great cycle, 9th cycle, 10th katun, and 14th ahau, we find the date is 10 Ahau 18 Mac. Fifteen months and 5 days from this just reaches 3 Chicchan 18 Yax. The series is therefore a correct one, formed upon the same plan as those of the Dresden codex, and without using anything not in the reach and comprehension of the aboriginal artist.

The series on plate XXIV of the Dresden codex (our plate LXXXII) appears to close with a minor addition (in the lower left-hand corner) to reach the desired date, just as the theoretic one given above, except that in this case the count is forward. The series includes the right half of the plate, and reads from right to left and by lines from the bottom upward, closing with the lines in the lower left-hand corner. Here the steps have been in part from 1 Ahau to 1 Ahau, hence with 260 as the primal factor. The last column is 9-9-16-0-0, then follows the number 6-2-0, 4 Ahau 8 Cumhu. The latter number changed into days is the lapse of time from 1 Ahau 18 Kayab, the last preceding date, to 4 Ahau 8 Cumhu. However, as there are some unusual features in regard to the additions in a part of this series, attention will again be called to it a little farther on.

In order to show that resort was had to increasing the added number to shorten the process, as was done in the theoretic example, the following example is given from plates LXX and LXXI of the Dresden codex. Ordinary numerals are used in place of the symbols, and the series, which in the codex ascends from right to left, is reversed; the days below the columns are also given:

(1)	(2)	(3)	(4)	(5)	(6)	(7)
			3	5	7	9
15	17	19	18	17	16	15
10	9	9	0	0	0	0
16	18	0	0	0	0	0
9 Oc	9 Eb	9 Ix	9 Ix	9 Ix	9 Ix	9 Ix

It will be seen by subtracting that the difference between the first and second columns and between the second and third is 1-17-2, or 1 ahan, 17 chuens, 2 days, equal to 702 days, while the difference between the 3d and 4th columns is 2-18-9-0, or 2 katuns, 18 ahaus, 9 chuens, 0 days—equal to 21,060 days; and that the difference between the 4th and 5th, the 5th and 6th, and the 6th and 7th is, in each case, 1-19-0-0, or 14,040 days. There is therefore an increase of the added number or factor in passing from the 3d to the 4th column.

It will be noticed that the days below the 1st, 2d, and 3d columns differ, while from this point onward they are all 9 Ix. The change in this respect requires a change in the counter. Why the counter was made larger in passing from the 3d to the 4th column than between the remaining columns is not clear, as the difference between the 3d and 4th columns would have reached the desired day, 9 Ix. It is possible that the month date, though it does not appear, was here taken into consideration. Assuming that the first 9 Ix (under the 3d column) was 9 Ix 2 Pop, year 8 Ben, the count forward of 1-19-0-0 would reach 9 Ix 12 Chen in the year 7 Akbal, while the count forward of 2-18-9-0 would reach 9 Ix 17 Mac, year 13 Ezanab. As the first counter (702) is not a multiple of 260 or of 20, it must have been based on 13, one of the factors of 260. The counters 14040 and 21060 are multiples of 260; and there is possibly something in the fact that the former (14040) is 54 times 260 and that the first counter (702) is 54 times 13. Although we are not able at present to solve all these problems, it is evident that the author of the codex increased the counter as he proceeded, presumably to shorten the process.

The series appears to close with two columns in the upper middle portion of plate LXX, the dates here having the month given. With these (notwithstanding the obliterated portion of the series) we might determine the true dates of the portion given above, and thus possibly solve, to some extent, the problems mentioned; but unfortunately there are so many errors in these two columns that it seems impossible to determine the true numbers and dates. The chuen number, or

number in the place of the second order of units, is 18 or 19 (there being a space where one dot may have been obliterated), either of which is wrong. The date below one is 9 Ix 20 Pop, the other is 9 Ix 13 Pax or Tzec, both of which are wrong, as Ix is never the 13th or 20th of the month.

A good example of this method of increasing the counter as the series proceeds is found on plates LXX-LXXIII of the same codex. Although this runs from right to left, we give it here in reverse order and in ordinary figures as follows:

(1)	(2)	(3)	(4)	(5)	(6)
					[1?]
3	6	9	13	16	19[1?]
5	10	15	0	5	10
4 Caban	4 Ik	4 Manik	4 Eb	4 Caban	4 Ik
(7)	(8)	(9)	(10)	(11)	(12)
1	1	1	1	1	2
4	8	11	14	17	3
15	0	5	10	15	0
4 Manik	4 Eb	4 Caban	4 Ik	4 Manik	4 Eb
(13)	(14)	(15)	(16)	(17)	
2	2	2	2	3	
6	9	11 [12?]	16	1	
5	10	15	0	5	
4 Caban	4 Ik	4 Manik	4 Eb	4 Caban	
(18)	(19)	(20)	(21)	(22)	
3	3	3	3	3	
4	7	11	14	17	
10	15	0	5	10	
4 Ik	4 Manik	4 Eb	4 Caban	4 Ik	
(23)	(24)	(25)	(26)	(27)	
4	4	4	4	4	
2	6	9	12	15	
15	0	5	10	15	
4 Manik	4 Eb	4 Caban	4 Ik	4 Manik	
(28)	(29)	(30)	(31)	(32)	
5	10	15	2	3	
1	2	3	0	0	
0	0	0	8	12	
4 Eb	4 Eb	4 Eb	0	0	
4 Eb	4 Eb	4 Eb	4 Eb	4 Eb	
(33)	(34)	(35)	(36)	(37)	
4	5	6	8	1	
0	1	1	1	12	
16	2	6	10	3	
0	0	0	0	0	
4 Eb	4 Eb	4 Eb	4 Eb	4 Eb	

The figures in parenthesis are merely arbitrary numbers given to the columns as a means of reference. The counter is 3-5, or 65 days,

from the first to the 28th column; but here a change takes place; the amount at this point, being 5-1-0, or 1,820 days, is doubled to form the 29th column, and is again added to form the 30th. Here again occurs an increase in the counter, in this case a large one, viz, to 1-5-5-0, or 9,100 days; but at the next step the added number to form the 32nd column is only 1-0-4-0, or 7,280 days, just one-half of the 31st column. This counter is used to the end of the series; however, the 8 in the 36th column is an evident mistake; it should be 7.

The number 65 is a very common counter in this and other codices; in this case 13 is the basal factor. In the other counters 260 is the permanent factor. The first counter, which is just one-fourth of the second, always reaches a day with the same number, though not the same day—but repeating by series of four. However, aside from these questions, we have the fact of the increase of the counter in the process, to show which was the object of calling attention to the series.

Returning now to the series on plate XXIV (our plate LXXII), to which reference has been made, I call attention to the unusual changes in the counter or added number. The series in the fourth tier from the bottom, given in the way adopted above, is as follows:

(1)	(2)	(3)	(4)
			1
1	4	9	5
5	12	11	14
5	8	7	4
0	0	0	0
1 Ahau	1 Ahau	1 Ahau	1 Ahau

The values of the different units and sums of the columns are as follows:

			144,000
7,200	28,800	64,800	36,000
1,800	4,320	3,960	5,040
100	160	140	80
0	0	0	0
<hr/>	<hr/>	<hr/>	<hr/>
9,100	33,280	68,900	185,120

It will be found by trial that the greatest common divisor of these totals is 260, and that it is contained in the first total 35 times; in the second, 126; in the third, 265, and the fourth, 712 times. Although each step must have required long and tedious additions—no two having a common added number or multiple thereof—and the reason for thus varying the added number is not apparent, yet it is evident that the aboriginal scribe chose 260 as the factor to be used, and also that the desired result could be reached by successive additions. In fact, the series and the others we have noticed seem to be mere records of the steps in the process of determining the lapse of time between two widely separated dates.

These examples are sufficient to show that all the series in the codices and inscriptions could have been formed by the aboriginal

authors with their numeral symbols by addition and subtraction. It may also be added that the evidence presented to show this is fitted to impress us with the belief that some, if not all, of the series of the Dresden codex are but records of the process of calculation.

There arises in connection with this examination a question, the proper answer to which may, if determined in accordance with a view that has been expressed, have an important bearing on the history of the Mayan tribes.

On several of the plates of the Dresden codex there are what appear to be supplemental series connecting with the so-called "normal date," 4 Ahau 8 Cumhu. However, the discussion of this question will come more appropriately under the next section, which relates to the signification of the series of the inscriptions.

SIGNIFICATION OF THE NUMERAL SERIES

Why were these series formed? What is their signification? These are questions impossible for us to answer satisfactorily with our present knowledge of the subject. It may be possible, however, to limit the inquiry by certain considerations.

Our first question is, Were they intended, by the initial or terminal days, to refer to actual dates bearing some relation to events in the history of the respective tribes to which they pertain? By the term "initial dates" I allude to the dates from which the series (whether initial or minor) were counted, and by "terminal dates" to those which follow the series in counting forward. The latter are assumed to be later in actual time than the former.

That the initial date may be thrown back any desired distance in time is admitted, as for example, we may take as our initial date the beginning of the Christian era (A. D.), or the supposed initial date of the world era (A. M.), or any other beginning date which, through fancy, tradition, or mythology, has been adopted or arbitrarily chosen by different peoples. It is not necessary, therefore, that we should assume that the initial dates of the Mayan codices and inscriptions have any reference to historical or even supposed historical events. That such an assumption would be preposterous is shown by the fact that several of these dates reach back in time 33,000 years, and a large proportion of those of the inscriptions nearly 4,000 years, and others to a still more distant time. The initial dates must therefore relate, as will be conceded, to some assumed date, traditional or mythological, or arbitrarily chosen, according to the fancy of the calculator.

Do the terminal dates refer to events or incidents in the history of the tribes—events which were noted down by the scribes sufficiently near the time of occurrence to give the proper or probable dates thereof?

If we take the terminal dates of the initial series at Quirigua (omitting from consideration those of the minor series) we find the difference between the earliest and latest, with two exceptions to be noticed, is only some 83 or 84 years. This difference is so moderate as to be entirely consistent with the idea that the dates were engraved near the time of the events or incidents to which they refer, if, in fact, this was the object in giving them. The two excepted are numbers 6 and 16 of the list given below. The calculation I give is based on what seem to be the reliable series and dates, leaving out of consideration the exceptional and doubtful series. Comparing the earliest and latest of those at Copan, we find the difference to be about 222 years. This is by no means extravagant, hence the dates may refer to historical events. When we come to those at Palenque, we find the difference—even excluding the most recent date, which Goodman admits is doubtful—to be over 3,800 years. Although a difference in dates as great or greater than this has been found in the inscriptions of the ruins of Egypt and Assyria and accepted as reasonably correct, no archeologist of the present day not carried away by some extravagant theory will believe that inscriptions were chiseled at Palenque at dates 3,800 years apart in actual time, the earliest (counting from the coming of the Spaniards) going back more than 2,200 years before the Christian era.

Now, it is the opinion of Goodman and Seler that the terminal dates of the inscriptions (the latter excepts those at Palenque, as explained below) refer to the times when the monuments were erected or the inscriptions chiseled. The assertion of the former on this point (pages 147–8) is as follows:

Particular emphasis is intended to be laid upon “initial” dates in the foregoing estimate. There are two kinds of dates in the Archaic inscriptions. The dates of one character, and those of most frequent occurrence, appear in the body of the texts, and designate the points from or to which the reckonings extend. Sometimes they are but a day apart; at others, they are a few months or years, while occasionally a flight is made over thousands of years and back again, with the ease and swiftness with which in Eastern story the couch of the prince is transported by genii. These dates have no significance beyond their relation to other dates and the corresponding reckonings.

But with the other class, the initial dates, as Maudslay has very appropriately named them, it is quite different. The inscription on nearly every temple, stela, and altar begins with one of them, reciting the great cycle, cycle, katun, ahau, chuen, month, and day. Such conspicuousness and circumstantiality, in my estimation, could have but a single purpose—that of recording the date at which the monument was erected. Some of the stelæ have different initial dates on opposite sides, but in these instances one date is reckoned from the other, the later one undoubtedly designating the time of dedication. I think there is nothing we can assume with more assurance of certainty than that these initial series mark the date of erection of the respective monuments.

Taking this for granted, also, we will turn to the inscriptions and see to what these conclusions lead. The latest initial date is found on a stela at Quirigua. It is 55–3–19–2–18×20—7 Ahau–18 Pop. That is 2,840 years subsequent to the

average of initial dates in the other Quirigua inscriptions. The next latest initial date is on a restored stairway in one of the temples of Palenque. It is 55-3-18-12-15 \times 12-8 Eb-15 Pop. That is 7,082 years later than the earliest initial dates at Palenque. These are long periods, but the limit is not yet reached. In the museum at Leyden is the misnamed "Yucatec" stone, exhumed in digging a cut on the line between British Honduras and Guatemala, about a hundred miles from Copan. It is a slim slab of jadite, about a foot long and four inches wide, if my recollection of it is correct. Both sides are inscribed in rather a rude manner, the rudeness apparently being more attributable to the hardness of the stone than to a lack of skill in the artist. The carving on the front represents a warrior trampling an enemy under his feet. The stone, therefore, is evidently a memorial of some victory or conquest. The inscription on the back consists of an initial date in the Archaic form and characters. It is 53-8-14-3-1 \times 12-1 Eb-5 Zac. That is 8,383 years anterior to the latest initial date in Quirigua. Now, if in accordance with my theory respecting the era of the Archaic cities the 2,348 years that have elapsed since that Quirigua date was made be added to the above period, we shall arrive at the time when that ancient Maya conqueror trod his enemies under foot—10,731 years ago—the oldest historical date in the world.

Dr Seler's opinion on this point is expressed in the following quotation from his paper in the *Zeitschrift für Ethnologie*, Heft 6, 1899:

I have, in conclusion, now to speak of the relation in which the various monuments which we have become acquainted with stand to each other. Here at the outset is to be kept in mind the noteworthy difference which exists between the altar plates of Palenque and the remaining monuments. I have already mentioned that the initial series of all monuments which we are able to read contain in the first member the multiplier nine; and I can add that the same holds also for the stelæ of Quirigua (which I have not yet been able to treat of, as they have not yet been published in Maudslay's work) and for stela 6 of Copan, excavated by the engineers of the Peabody Museum. On the altar plates of Palenque, on the contrary, so far as we have been able to decipher them, there stands in the first member the multiplier one. If, as indeed is a priori most probable, the date designated at the end of the first series gives the time of erection of the monument in question, then we must conclude that all other monuments within the tenth cycle after the beginning and normal date 4 Ahau 8 Cumku—the Temple of the Cross II of Palenque, the Temple of the Sun, and perhaps also the Temple of the Cross I—were constructed within the second cycle after the beginning and normal date. In other words, we must conclude that between the time of the erection of the temples of Palenque and of all the other monuments there lies a period of about 3,160 years; that the temples of Palenque are about 3,160 years older than the monuments of Copan and Quirigua, and than the steps of the towering palace of Palenque not far from the temple. This is, in itself, not probable, and all the less so as one would, from the style of the hieroglyphs and figures, be rather inclined to explain the temples of Palenque as younger than the stelæ of Copan. The solution of the riddle may be a different one. It may be that, in the initial series of the temples of Palenque, the end date does not represent the date of erection of the temple, but an earlier sacred date which it had been determined to bring into view. It may, however, also be that the time of the erection of the monument was brought into view, not through notation of the actual traditionally accepted distance from the normal date, but as it were in arithmetical fashion through notation of *one* difference which led from the normal date to a day of this name.

The end dates of all the remaining monuments which we are able to read fall, as said, within the tenth cycle after the beginning and normal date 4 Ahau, 8 Cumku.

It is apparent from these quotations that both Goodman and Seler hold the opinion that the terminal date in an initial series is intended to indicate the time when the monument was erected, though the lapse of time given by Goodman (who does not seem to object to long periods) to the dates of erection of the various monuments differs very widely from that allowed by Seler. The differences I have indicated are, as was stated above, limited to those which remain after rejecting those which seem doubtful.

Let us discuss this question on the data furnished by the inscriptions and Dresden codex, taking, where there are not good grounds for objecting to them, the interpretations of the initial series by Goodman and Seler. Differences in the numbers of the periods or orders of units below that which Goodman terms "katun" have no bearing in this discussion. In order that the reader may have the data before his eye, I give below a list of the initial series, retaining, for convenience, Goodman's great cycle numbers. The numbers at the left are merely for reference.

Palenque

(1) 53-12-19-13- 4- 0,	8 Ahau	18 Tzec.	Temple of the Cross.
(2) 54- 1-18- 5- 3- 6,	13 Cimi	19 Ceh.	Temple of the Sun.
(3) 54- 1-18- 5- 4- 0,	1 Ahau	13 Mac.	Temple of the Foliated Cross.
(4) 54- 9- 4- 0- 0- 0,	13 Ahau	18 Yax.	Temple of Inscriptions.
(5) 55- 3-18-12-15-12,	8 Eb	15 Pop.	Inscribed steps of palace.

Quirigua

(6) 54- 9- 1- 0- 0- 0,	6 Ahau	13 Yaxkin.	Stela C, west side.
(7) 54- 9-14-13- 4-17,	12 Caban	5 Kayab.	Stela F, west side.
(8) 54- 9-14-13- 4-17,	12 Caban	5 Kayab.	Stela E, west side.
(9) 54- 9-16- 5- 0- 0,	8 Ahau	8 Zotz.	Stela J, back.
(10) 54- 9-16-10- 0- 0,	1 Ahau	3 Zip.	Stela F, east side.
(11) 54- 9-16-13- 4-17,	8 Caban	5 Yaxkin.	Stela D, west side.
(12) 54- 9-17-10- 0- 0,	12 Ahau	8 Pax.	Animal B.
(13) 54- 9-17- 5- 0- 0,	6 Ahau	13 Kayab.	Stela A, east side.
(14) 54- 9-17-15- 0- 0,	5 Ahau	3 Muan.	Animal G.
(15) 54- 9-18-15- 0- 0,	3 Ahau	3 Yax.	Stela K.
(16) 54-13- 0- 0- 0- 0,	4 Ahau	8 Cumhu.	Stela C.
(17) 54- 9-16-15- 0- 0,	7 Ahau	18 Pop.	Stela D, east side.

Copan

(18) 54- 9- 5- 5- 0- 0,	4 Ahau	13 Zotz.	Stela D.
(19) 54- 9- 9-10- 0- 0,	2 Ahau	13 Pop.	Stela P.
(20) 54- 9-12- 3-14- 0,	5 Ahau	8 Uo.	Stela I.
(21) 54- 9-12-12- 0- 0,	1 Ahau	8 Zotz.	Stela J, west side.
(22) 54- 9-12-16- 7- 8,	3 Lamat	16 Yax.	Altar K.
(23) 54- 9-13-10- 0- 0,	(7 Ahau	13 Cumhu.)	Stela J, east side.
(24) 54- 9-14-10- 0- 0,	5 Ahau	3 Mac.	Stela F.
(25) 54- 9-14-19- 8- 0,	12 Ahau	18 Cumhu.	Stela A.
(26) 54- 9-15- 0- 0- 0,	4 Ahau	13 Yax.	Stela B.
(27) 54- 9-15- 0- 0- 0,	4 Ahau	13 Yax.	Altar S.
(28) 54- 9-16-10- 0- 0,	1 Ahau	8 Zip.	Stela N.
(29) 54- 9-16- 5- 0- 0,	8 Ahau	8 Zotz.	Stela M.
(30) 55- 2- 6- 0- 0- 0,	?	?	Altar L.
(31) 55-13- 2-18- 0- 0,	6 Ahau	18 Kayab.	Stela C.

The Leyden Stone

(32) 53- 8-14- 3- 1-12, 1 Eb 5 ?(Yaxkin?).

Goodman also mentions (p. 148) the following as at Quirigua:

(33) 55- 3-19- 2- 0- 0, 7 Ahau 18 Pop. Stela ?

Examining this list, we see that the terminal dates of 24 out of the 33 series fall in the 10th (Goodman's 9th) cycle from 4 Ahau 8 Cumhu, the initial day of Goodman's 54th great cycle. It can not be doubted, therefore, as we also find the same initial date the most prominent one in the Dresden codex, that, for some reason unknown to us, it was selected by the people who made the inscriptions and codex as their principal era date. As the 24 series ending in the 10th cycle run back from the earliest terminal date (number 6) 9-1-0-0-0, or 3,570 years, and from the latest terminal date (number 15) 9-18-15-0-0, or 3,920 years, it is evident, as has been stated above, that the normal date (4 Ahau 8 Cumhu) selected as the commencement of this era could have no reference to an historical event remembered by the Mayan people. Even if we suppose that the last of these inscriptions was not chiseled until the close of the fifteenth century, this would carry back the era date 2,400 years before the Christian era. The only safe and reasonable conclusion, therefore, is that the initial date was arbitrarily selected for some mythological, mystical, or arithmetical reason. It is especially worthy of notice, however, that the lapse of time between the terminal dates of the earliest and latest of these series is only about 350 years, and, if number 6 be omitted, less than 90 years. This fact would seem to give color to the suggestion of Goodman and Seler that the terminal dates of the initial series refer to the time the monuments were erected. Nevertheless, there are some serious difficulties to be overcome before this theory can be considered as satisfactorily established, some of which it will be my object now to point out.

So far as the foregoing list is concerned, all the series which begin with 9 cycles (the 54 indicating the so-called great cycle is omitted from consideration) have, beyond question, the initial date 4 Ahau 8 Cumhu. It must be remembered, however, that this date returns at the end of every count of 18,980 days, or 52 years. Now, the question arises (and it is a crucial one in this discussion), Does the count in each one of these series go back to identically the same 4 Ahau 8 Cumhu, or merely to any 4 Ahau 8 Cumhu? If, as I think I have successfully shown, the so-called ahaus, katuns, cycles, and great cycles are not absolute time periods, recognized as such in any Mayan time system, but are mere orders of units in the Mayan method of numeration, these counts would be precisely like the following in our ordinary time system: Thursday the 15th day of the 7th month of the 48th year of the century. What century? Or 1,025 years, 7 months and 15 days from December 25th to Thursday the 9th day of the 8th month. It is evident that without the first or last date being fixed in some recog-

nized calendar the 1,025 years, etc., may be pushed backward or forward at will. Hence a Mayan scribe may write 9-15-0-0-0 from 4 Ahau 8 Cumhu to 4 Ahau 13 Yax (as in number 26); and 52 years later another may write the same series, as in number 27, and both will be strictly correct, but the 4 Ahau 8 Cumhu of the first will be 52 years earlier than that of the second. The mere fact, therefore, that 4 Ahau 8 Cumhu is reached by counting back the different numeral series is not evidence that in each case identically the same 4 Ahau 8 Cumhu is reached. Other evidence having some bearing on the question must be introduced to establish this identity. The only fact apparent in the series themselves which seems to favor the theory of identity is that each runs back 9 cycles plus the minor numbers. This undoubtedly favors the theory of identical date.

Let us turn now to the Dresden codex, and give attention to what I have termed subsidiary series; that is to say, short series apparently, as was suggested in the theoretical series given above, intended to connect with 4 Ahau 8 Cumhu. As I have expressed doubts as to the correctness of Seler's suggestion about that on plate LXIX, attention is called to the long compound series on plate XXIV (see our plate LXXXII). This series begins at the right-hand edge of the bottom section and runs leftward to the middle; it then passes to the next section above, and so on to the top of the page, the concluding column being that in the lower division of the left-hand portion. No months are given except at the bottom of the long number columns and the one short column in the lower left-hand portion of the plate. The last date standing in the lower left-hand corner is 4 Ahau 8 Cumhu, and over it is the number series 6-2-0 (the 0 symbol in a red loop). The next date to the right is 1 Ahau 18 Kayab; this stands under the numeral series 9-9-16-0-0. Counting back from 4 Ahau 8 Cumhu, the short series, 6 ahaus, 2 ehuens, 0 days, or 2,200 days, we are brought to 1 Ahau 18 Kayab, while if we count forward from the same date it brings us to 7 Ahau 18 Cumhu, which shows the backward count to be the correct one, if the design of the artist was to connect the two series; moreover, the count of the long series, if made toward the right, is backward.

We know that in all the series given in the above list, where 4 Ahau 8 Cumhu is the principal date, it is the initial day and the numeral series follows it; in other words, the count must be backward to reach it. Taking number 15 of the list—Stela K of Quirigua—54-9-18-15-0-0—we find that the terminal date lies 3,920 years subsequent to 4 Ahau 8 Cumhu. Turning to the last column of the series on plate XXIV of the Dresden codex, which is 9-9-16-0-0, we find that the count, when the short series of 2,200 days is added, reaches backward from 4 Ahau 8 Cumhu 3,750 years. In other words, we count forward in the codex 3,750 years to 4 Ahau 8 Cumhu, and in the inscription series forward from this date 3,920 years, making the total

lapse of time from the beginning date of one and the ending date of the other 7,670 years. Is it at all probable that the one 4 Ahau 8 Cumhu is the same in actual time as the other? That the count is necessarily forward in the codex series may be proved thus: The last column (that in the lower left-hand portion) reaches back to the initial date, which is found to be 1 Ahau 18 Kayab, the same as the terminal date which stands below the column. Now if the supposition be correct that, as is usual in this codex, this column is the sum of the series, and there is no mistake on the part of the aboriginal artist, the first number column, that in the extreme lower right-hand corner of the plate, 8-2-0, 9 Ahau (the symbol appears to be 8, but the fourth dot is hid by the red border line, as can easily be shown by the steps from date to date toward the left) should give the exact lapse of time from 1 Ahau 18 Kayab. Counting forward 8-2-0, or 2,920 days, from 1 Ahau 18 Kayab, year 2 Akbal, we reach 9 Ahau 18 Kayab, year 10 Akbal, the date under this first column. Counting forward 2,920 days (the difference between the first column and the next one to the left) from the last date (9 Ahau 18 Kayab), we reach 4 Ahau 18 Kayab, year 5 Akbal, the date under the second column. Counting back the sum of this second column—5,840 days—we reach, as we should, 1 Ahau 18 Kayab, the initial date.

As further proof that the series is continuous and the count forward, let us select at random the third column, counting from the right, of the third section from the bottom, to wit, 4-8-4-0, 11 Ahau. Counting forward 32,120 days, the sum of this column, from 1 Ahau 18 Kayab, we reach 11 Ahau 18 Kayab, year 12 Akbal—the day under this column. If we take the column immediately above (third from the right in the fourth division from the bottom of the page) which reads 9-11-7-0, 1 Ahau, equal to 68,900 days, and count forward from the initial date 1 Ahau 18 Kayab, we reach 1 Ahau 13 Mac, year 9 Lamat. Subtracting this column from that to the left of it—

$$\begin{array}{r} 1-5-14-4-0 \\ 9-11-7-0 \\ \hline 16-2-15-0 \end{array}$$

we find the remainder to be 16-2-15-0, or 116,220 days. Counting forward this number of days from 1 Ahau 13 Mac, the date under the third column from the right, we reach 1 Ahau 18 Uo, year 3 Akbal, the date under the last or fourth column from the right, which proves the steps thus far taken to be correct.

Although the upper division is too nearly obliterated for any of its columns to be used to calculate forward to the final column, we can do this as correctly by subtracting the last column of the fourth division from the terminal column of the entire series, thus—

$$\begin{array}{r} 9-9-16-0-0 \\ 1-5-14-4-0 \\ \hline 8-4-1-14-0 \end{array}$$

Using this remainder, which amounts to 1,181,440 days, subtracting from it 62 calendar rounds or 1,176,760 days, which leaves a balance of 4,680 days, and counting forward from 1 Ahau 18 Uo (the date under the left column of the fourth division), we reach 1 Ahau 18 Kayab, the date under the final column in the lower left portion of the plate. No doubt, therefore, is left that the count in this long series is toward the left and forward in time, and that the 1 Ahau 18 Kayab under the final column is 3,744 years later in time than the initial date, which is also 1 Ahau 18 Kayab.

Counting forward from this terminal date the short series in the extreme lower left-hand column (2,200 days), we reach 4 Ahau 8 Cumhu, the date in the corner below this short column. It is certain, therefore, that 4 Ahau 8 Cumhu is the terminal date of the long series on this plate. Is it the "normal date," the same initial 4 Ahau 8 Cumhu from which the series of inscriptions are counted? To show that Goodman's calculations agree exactly with this result, we have only to count back on his chronological tables from 4 Ahau 8 Cumhu, the first day of his 54th great cycle, the 9 cycles, 9 katuns and 16 ahaus of the final large column and the 6 ahaus of the short column. This will reach 2 Ahau 13 Pop, the first day of the 18th ahau of the 9th katun of the 3rd cycle of his 53rd great cycle. Counting back from this the two months of the short column we reach 1 Ahau 18 Kayab, the initial day of the long series of the codex plate.

This fact will tend to throw a strong doubt on the theory of Goodman and Seler in regard to the signification of the series. Moreover, if we turn to plate LXX of the codex we see high numbers, some reaching to 8 and others to 9 cycles, one being as high as 9-19-11-13-0. These are followed by a short subsidiary series ending with 4 Ahan 8 Cumhu. Here, then, this "normal date" comes after the long series of 3,937 years, and if Seler's idea that the 4 Ahau 8 Cumhu in the texts of plates LXI and LXIX is to be connected with the high series in the serpent figure be correct, then it must stand at the commencement of a period extending back from the terminal date some 33,900 years.

As an example clearly illustrating the statements in the preceding paragraph occurs on plate XLIII of the Dresden codex, I shall notice it here before passing from the point under discussion. This consists of a single column shown in figure 166. At the head of the column is the day 3 Lamat; immediately below is a figure with a turned-up nose, probably a conventionalized tapir head, which, as it occupies the same relative position as the great cycle symbol in the inscrip-



FIG. 166. Column from plate XLIII, Dresden codex.

tion, may, and in fact probably does, stand for the same purpose here. Following the latter, reading downward, is the series 9-19-8-15-0 (9 cycles, 19 katuns, 8 ahaus, 15 chuens, 0 days); next comes the day 3 *Lamat*, which is followed by the short series 17-12 (17 chuens, 12 days), the column ending with the day 4 *Ahau*, though no month symbol is given.

Assuming the date at the bottom to be 4 *Ahau* 8 *Cumhu*, we count back 17 months and 12 days (=352 days) from this date. This brings us to 3 *Lamat* 1 *Uayeb* in the year 7 *Lamat*. Counting back from the latter date 9-19-8-15-0, or 1,435,980 days, we reach 3 *Lamat* 11 *Muan*, year 12 *Ezanab*, the day standing at the head of the column. It is true that we have no absolute proof that the terminal date (4 *Ahau*) is intended for 4 *Ahau* 8 *Cumhu*, as the count will give the same result from any other 4 *Ahau*. The column given is the sum of—that is to say, includes—the long series which occupies the right portion of the middle section of plate XLIII and the left portion of the middle section of plate XLIV, and seems to be here precisely what an initial series is in the inscriptions. This supposition, which seems to be confirmed by the tapir-head symbol, which apparently stands for the great cycle, is in direct opposition to the assumption that

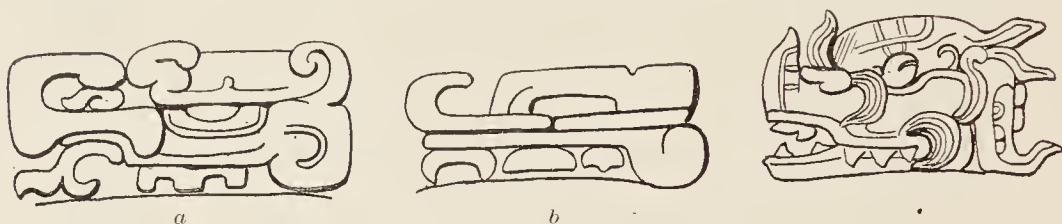


FIG. 167. Centerpieces of great cycle symbols.

the terminal 4 *Ahau* is the initial day of a great cycle. On the other hand, the assumption that it is the initial day of a great cycle, as Seler seems to think, necessitates the conclusion that the date 3 *Lamat* 11 *Muan*, from which the count of the series starts, is not the beginning of a great cycle, or that great cycles may overlap one another. The latter conclusion would indicate that the starting point is arbitrary, and that the supposed time-periods are simply orders of units in expressing numbers.

At any rate, if the 4 *Ahau* is assumed to be 4 *Ahau* 8 *Cumhu*, the whole of the series lies back of, or anterior to, the commencement of Goodman's 54th great cycle.

As an indication that the conventional tapir head on plate XLIII of the Dresden codex is used as a great cycle symbol, attention is called to the centerpieces of the three great cycle symbols shown in figure 167, the one marked *a* being from the east side of Stela F, Quirigua; *b* from Stela N, Copan, and *c* from Stela 6, Copan. The resemblance to the codex symbol is too strong to be overlooked.

In addition to these facts which seem to stand against, or at least to render doubtful, the supposition that 4 *Ahau* 8 *Cumhu*, when stand-

ing as the initial or terminal day of a series, is to be taken as the date of the chosen era, there is the additional fact that in quite a number of the inscriptions there are series connected with, but subsequent to, the initial series, sometimes running into the hundreds of years. If the terminal date of the initial series designates the date of erection, then the other subsequent dates must have been chiseled after the monument was erected. This would require the supposition that the tablets at Palenque were quarried and dressed to a particular size with a profound knowledge of or keen foresight as to the additional space that would be needed in the coming years.

Such are some of the difficulties that stand in the way of the theory advanced by Goodman and Seler as to the signification of the inscriptions. Nor are these all the difficulties; others appear when we discard Goodman's theory of a great chronological system and look upon his so-called time-periods as but orders of units, and count, as should be done, 20 of the 5th order of units (cycles) to one of the 6th order (great cycle). However, notwithstanding these serious difficulties, the theory, if a little more generalized, so as to apply to the latest date in the inscription as that denoting the time of erection or event commemorated, is perhaps the most acceptable which has been presented, though it be very doubtful. Many of the long series in the Dresden codex appear, in fact, to be records of the steps of calculation in finding the lapse of time between widely separated dates, seemingly for amusement or mystical purposes. The author of the Dresden codex seems to have been of a mathematical turn—far more so than the authors of the Troano and Cortesian codices, which fact probably accounts for the long series in the former; and it may be added that a strong mathematical turn of mind has probably led Mr. Goodman to form his grand but, unfortunately, imaginary Mayan chronological system.

INSCRIPTION AT XCALUMKIN, YUCATAN

Attention is called again to figure 157 (page 253), showing an inscription found at Xcalumkin, Yucatan, by Mahler and photographed by him. A copy was obtained by Dr Le Plongeon and published in his "Queen Moo" (page 80, plate xxv), but without any particulars or attempt at explanation. As Mahler has not, so far as I am aware, published any account of this discovery, and I am indebted to Dr Saville for the copy used, I can only refer to the inscription, which is certainly interesting in several respects.

It is apparent at a glance that the majority of the symbols differ very considerably from those at Palenque, Tikal, Copan, and Quirigua to which reference has been made in my previous paper and the first part of this paper. So great is the difference that we are unable to say whether the first symbols, A1 to B2, are numeral characters representing an initial series. That the part of A3 which is a cartouch inclosing a serpent is to be taken as a day symbol may be safely

assumed. If this surmise be correct, it is a type different from any hitherto found in a Mayan inscription. If a Mayan day symbol, it must, beyond any reasonable doubt, represent Chicchan, which is the only day in the calendar that has received the interpretation "Serpent," and is that which corresponds in position with *Cohuatl* in the Mexican calendar. If this conclusion be correct, it confirms Brinton's interpretation of the name "Chicchan" (Native Calendar, page 25).

The important glyphs of this inscription are the two at the bottom, A6 and B6. These I think may safely be read "8 Caban 4 Zotz," and in this I am glad to say that Saville agrees with me. Whether the determination of the month symbol be correct or not, the four dots over it are clear and distinct, showing the day to be the 4th of the month. There can scarcely be any doubt that the day symbol is that of Caban, which can only be the 4th day of the month in years

beginning with *Ix*. This conforms to the calendar of the *Troano* and *Cortesian* codices and that used by *Landa*, in which the dominical days are *Kan*, *Muluc*, *Ix*, *Canac*.

This is a very important fact, which, if corroborated by other discoveries, will carry back the use of the *Yucatec* calendar to an early date. I was inclined to the opinion that this calendar was of comparatively recent date, but this evidence, if accepted, must carry it back to the era of the inscriptions, and place it, in time, parallel with that of the other sections.

A single date, it is true, is slender evidence on which to base a conclusion of so much importance as this. However, as

it is the only evidence as yet obtained bearing on the question, it must be accepted until other data are obtained. It is possible that one other date is given by *Maudslay* in plate XIX, part 5, in an inscription found at *Chichen-Itza* and shown in our figure 168. Possibly this may be intended for ? *Ahau 2 Cnmhu*, and if so would be the second day of the month in *Canac* years, and in accordance with the *Yucatec* calendar. It must be admitted, however, that this is very doubtful. It will be noticed that in the inscription from *Xcalumkin* the glyph B3, to the right of the supposed *Chicchan* symbol, consists of two faces, hence is presumably double, and over each are two large dots. If the first or left one be intended for a month symbol, there is still correspondence with the *Yucatec* calendar, as *Chicchan* is the second day of the month in *Kan* years. However, it must be admitted that as yet we are unable to solve the problem.

In regard to the types of the glyphs their nearest approach is to those on *Stela P*, *Copan* (see *Maudslay*, plate LXXXVIII, part 4).

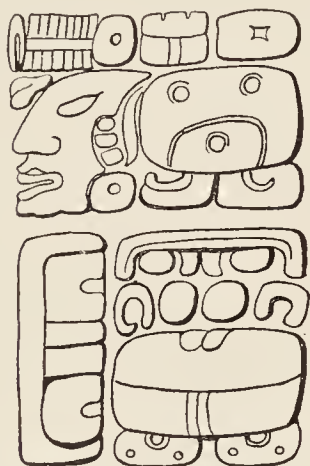


FIG. 168. Two symbols from a Chichen-Itza inscription.

INSCRIPTION ON STELA 6, COPAN

In figure 169 is given a copy of an inscription on Stela 6 at Copan. As the photograph of this inscription has been kindly furnished by Dr Saville, who may intend to publish further notice of it, I shall notice only the initial series.

This series is as follows (the great cycle being neglected): 9-12-10-0-0, 9 Ahau 18 Zotz. The chuen and day symbols are too indistinct to be determined by inspection. The symbol of the day 9 Ahau is the right-hand portion of glyph B2; and that of 18 Zotz is the right-hand portion of glyph B4. Changing the 9 cycles, 12 katuns, and 10 ahaus to days gives the following result:

	Days
9 cycles.....	1,296,000
12 katuns.....	86,400
10 ahaus.....	3,600
Total.....	1,386,000
Subtract 73 calendar rounds..	1,385,540
Remainder.....	460

Counting back 460 days from 9 Ahau 18 Zotz, year 10 Akbal, we are brought to 4 Ahau 8 Cumhu, year 8 Ben, the initial day of Goodman's 54th great cycle. The series, as given above, may therefore be accepted as correct, and the lower part of glyph A2 as denoting 0 chuens, 0 days, or at least 0 chmens. Enough of the left half of the lower portion of this glyph remains to show beyond question the symbol of full count or naught.

Dr Saville has also presented me with photographs of inscriptions discovered at Seibal, Guatemala, but these are short and contain no initial series. The only peculiarity noticeable is the prominence at this place of the date 3 Ahau 3 Kayab, which stands at the head of some of the inscriptions. This shows that the calendar used here was the same as that in use at the other points not in Yucatan, to wit, that having Akbal, Lamat, Ben, and Ezanab as the dominical days.



A B
FIG. 169. Inscription on Stela 6, Copan. From photograph by Saville

THE NEPIRITE STONE OF THE LEYDEN MUSEUM

Reference is made to the inscription on this stone (figure 170), which has been frequently noticed heretofore, merely to show the date from which the initial series is counted. The series is as follows,

omitting the great cycle: 8-14-3-1-12, 1 Eb 5 (month). The month symbol, though distinct, is unusual, in fact unique, unless it includes the "kin" glyph immediately below, which is very probable; in this case it is most like the Yaxkin symbol. Reducing the series to days and subtracting 66 calendar rounds, we have the following result:

	Days
8 cycles -----	1, 152, 000
14 katuns -----	100, 800
3 ahaus -----	1, 080
1 chuen -----	20
12 days -----	12
Total -----	1, 253, 912
Subtract 66 calendar rounds---	1, 252, 680
Remainder -----	1, 232

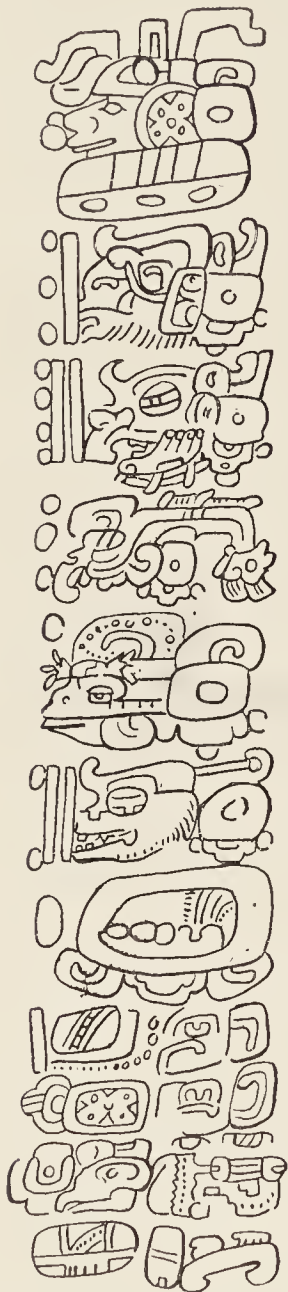


FIG. 170. Inscription on the nephrite stone in the Leyden Museum.

Counting forward 1,232 days from 4 Ahau 8 Cumhu, the first day of Goodman's 54th great cycle, Seler's "normal date," we reach 4 Ix 10 Xul. This is wrong; but by counting forward from 4 Ahau 8 Zotz, the first day of Goodman's 53rd great cycle, we reach 1 Eb 5 Zac, which agrees with the inscription so far as the day and day number and the day of the month are concerned, but still leaves the doubt as to the month. This result also agrees with Goodman's tables and his interpretation of this series (page 148). Assuming it to be correct, we find the terminal date to be 618,088 days back of or anterior to the "normal date," 4 Ahau 8 Cumhu; and the commencement of the 10th (Goodman's 9th) cycle of the 54th great cycle stands 1,296,000 days after this normal date; hence the time of inscribing the series on the nephrite stone (assuming the terminal date to indicate this time) was 5,244 years anterior to the beginning of the 10th cycle, the anterior limit fixed by Seler for the date of

the inscriptions. However, it must be remembered that this calculation is based on the theory that the series on this stone falls in one of the three great cycles tabulated by Goodman. This theory, as is

apparent from what has been shown in this paper, is not entirely satisfactory. If the count be backward from 1 Eb 5 Yaxkin, the apparent date of the inscription, we reach, as the beginning day of the series, 4 Ahau 13 Cumhu, which is the initial day of Goodman's 11th great cycle; but it must be remembered that 4 Ahau 13 Cumhu will appear again and again, in fact hundreds of times, and at much more recent dates than this immense stretch of more than 224,500 years. Moreover, it is proper to bear in mind the fact that Goodman's list of 73 great cycles covers the list of ahaus or 360-day periods commencing with 4 Ahau; hence any date having 4 Ahau will be found somewhere in it.

CALENDAR AND NUMBER TABLES

Although the following tables are given in my previous paper, it is thought best to reinsert them on the following pages (303, 304) for the convenience of readers disposed to test the calculations made in this paper.

Days and months of the four series of years

Akbal year	Lamat year	Ben year	Ezanab year	Days of month
Akbal	Lamat	Ben	Ezanab	1
Kan	Muluc	Ix	Cauac	2
Chicchan	Oc	Men	Ahan	3
Cimi	Chuen	Cib	Imix	4
Manik	Eb	Caban	Ik	5
Lamat	Ben	Ezanab	Akbal	6
Muluc	Ix	Cauac	Kan	7
Oc	Men	Ahan	Chicchan	8
Chuen	Cib	Imix	Cimi	9
Eb	Caban	Ik	Manik	10
Ben	Ezanab	Akbal	Lamat	11
Ix	Cauac	Kan	Muluc	12
Men	Ahan	Chicchan	Oc	13
Cib	Imix	Cimi	Chuen	14
Caban	Ik	Manik	Eb	15
Ezanab	Akbal	Lamat	Ben	16
Cauac	Kan	Muluc	Ix	17
Ahan	Chicchan	Oc	Men	18
Imix	Cimi	Chuen	Cib	19
Ik	Manik	Eb	Caban	20

Working tables

Calendar rounds				Calendar rounds			
1	18,980	21	398,580	41	778,180	61	1,157,780
2	37,960	22	417,560	42	797,160	62	1,176,760
3	56,940	23	436,540	43	816,140	63	1,195,740
4	75,920	24	455,520	44	835,120	64	1,214,720
5	94,900	25	474,500	45	854,100	65	1,233,700
6	113,880	26	493,480	46	873,080	66	1,252,680
7	132,860	27	512,460	47	892,060	67	1,271,660
8	151,840	28	531,440	48	911,040	68	1,290,640
9	170,820	29	550,420	49	930,020	69	1,309,620
10	189,800	30	569,400	50	949,000	70	1,328,600
11	208,780	31	588,380	51	967,980	71	1,347,580
12	227,760	32	607,360	52	986,960	72	1,366,560
13	246,740	33	626,340	53	1,005,940	73	1,385,540
14	265,720	34	645,320	54	1,024,920	74	1,404,520
15	284,700	35	664,300	55	1,043,900	75	1,423,500
16	303,680	36	683,280	56	1,062,880	76	1,442,480
17	322,660	37	702,260	57	1,081,860	77	1,461,460
18	341,640	38	721,240	58	1,100,840	78	1,480,440
19	360,620	39	740,220	59	1,119,820	79	1,499,420
20	379,600	40	759,200	60	1,138,800	80	1,518,400

Ahaus		Katuns		Cycles	
1	360	1	7,200	1	144,000
2	720	2	14,400	2	288,000
3	1,080	3	21,600	3	432,000
4	1,440	4	28,800	4	576,000
5	1,800	5	36,000	5	720,000
6	2,160	6	43,200	6	864,000
7	2,520	7	50,400	7	1,008,000
8	2,880	8	57,600	8	1,152,000
9	3,240	9	64,800	9	1,296,000
10	3,600	10	72,000	10	1,440,000
11	3,960	11	79,200	11	1,584,000
12	4,320	12	86,400	12	1,728,000
13	4,680	13	93,600	13	1,872,000
14	5,040	14	100,800	14	2,016,000
15	5,400	15	108,000	15	2,160,000
16	5,760	16	115,200	16	2,304,000
17	6,120	17	122,400	17	2,448,000
18	6,480	18	129,600	18	2,592,000
19	6,840	19	136,800	19	2,736,000
20	7,200	20	144,000	20	2,880,000

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